ELECTRICAL REVIEW

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Antediluvian Underwriters.

INSURANCE OF WAREHOUSES USING ELECTRIC LIGHTS.

Probably the largest and most important warehouses in the world are those of the New York Terminal Warehouse Company, at the foot of Fifty-ninth street, in this city. Mr. B. H. Lane, the general manager of this company, is a gentleman of progressive ideas. Desiring to increase the facilities for handling his customers' goods, he thought it would be well to install an incandescent electric light plant in the warehouses, which are quite dark even on the brightest days. Accordingly, Mr. Lane gave the Thomson-Houston Electric Company the order for an incandescent plant to run at the regular 110 volt pressure. The plant was put in, and Mr. Lane sent to the New York Board of Fire Underwriters for an inspector to come and pass upon the electrical installation.

The board refused to inspect the plant, much to Mr. Lane's surprise, giving as a reason, an arbitrary rule made by the board some 25 years ago, which says that no light other than that given by a lantern burning lard or sperm oil shall be used within a warehouse building. Furthermore, the lantern must be locked, so that it may not be opened in the building by the workman using it.

Mr. Lane had been using lanterns in the warehouses, but supposed, quite naturally, that the introduction of incandescent light would materially lessen the hazard of the risk to the insurance companies. The Board of Fire Underwriters advanced the arguments that the introduction of electric lights would make it possible to work two shifts of men in the warehouses, a day and a night gang, and would, therefore, double the risk. The other argument was that if the board allowed electric lights in the buildings of the New York Terminal Warehouse Company, it would establish a precedent, and other warehousemen would want electric lights, too. To the first argument, Mr. Lane replied that he was willing to pay an increased rate of premium for his insurance, if the board would only inspect his plant and let him turn on current. The board refused to recognize Mr. Lane's right to use electric lights, and would not examine the plant.

Mr. Stephen E. Barton, of the Electric Mutual Insurance Company, of Boston, has examined the risks and has pronounced them perfectly safe for any insurance company to write. Mr. Barton's ability as an insurance expert is well known, but the New York Board of Fire Underwriters, in spite of Mr. Barton's opinion, and that of many New York insurance experts, still maintains its mulish attitude, and there the matter rests awaiting a solution.

An International Cable System.

Mr. J. Henniker Heaton, Member of Parliament for Canterbury, is now in Canada, and in a long interview with a representative of the Boston *Herald*, he spoke practically as follows of his pet scheme for cheapening cable messages between England and Australia. He says that the average cost of such messages is now $30, and that one message recently sent from England cost $7,000. He proposes to lay a cable from Vancouver to Australia, by way of Hawaii and Fiji, preferably as a State enterprise by all interests concerned. As laid down, the length of line would be as follows:

Brisbane or Sydney to North Cape	1,300 knots
North Cape to Fiji	1,240 "
Fiji to Fanning Island	2,270 "
Fanning to one of the Sandwich Islands	1,260 "
Sandwich Islands to Vancouver Island	2,730 "
Vancouver Island to Vancouver City	100 "
Total	8,900 knots

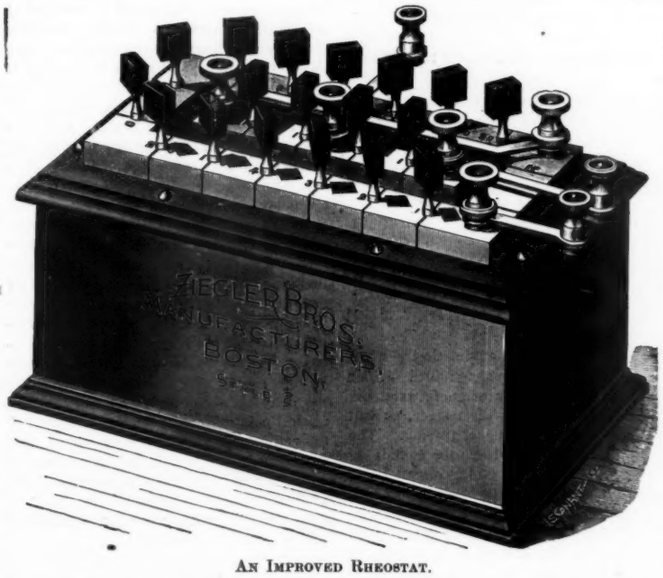
Mr. Heaton estimates the cost of this 9,000 miles of cable at $10,000,000, and that when connected with the telegraph system of the Canadian Pacific Railway and the Atlantic cable to Valencia it would have a capacity of 10,000,000 words per year, and would produce a revenue of $2,500,000. He says a private company has offered to do the work for a subsidy of $450,000 per year, but as the government could raise the necessary capital at three per cent., the interest charges on the estimated $10,000,000 for construction would only be $300,000 per year, and this would be reduced by the saving of $50,000 in the transmittal of government messages. To carry out this scheme would require the absorption by the government of all existing companies affected, but these only represent $52,500,000 of capital. Many of these lines are old; 180 miles of them have been submerged 18 years; 2,400 miles, 17 years; 2,724 miles, 16 years, and 1,283 miles 15 years. The 12,035 miles in the Eastern extension could be reconstructed to-day for $11,000,000. Assuming this as a fair purchasing price, the total cost of the new international system would be about $21,000,000.

The interest on the above amount would be $630,000, but the purchase of the Eastern Extension Company's business would extinguish subsidies now paid by the colonies annually, amounting to $283,500. The Hawaiian government also offers to further reduce interest account by a grant of $20,000 per annum. Mr. Heaton concludes, therefore, that it is folly to subsidize a private company with $450,000 when the government can carry on the work for about $300,000 for interest on the investment, and make a possible profit, at reduced rates, of $2,000,000 per year.

New Rheostat.

The accompanying illustration shows a rheostat manufactured by Messrs. Ziegler Brothers, Boston, Mass. This instrument is classified as Rheostat No. 2. It has coils ranging from one ohm up to 2,000 ohms, producing a total resistance of 4,110 ohms. The box is made of highly polished and nicely finished mahogany and the top consists of hard rubber. The plugs are neatly fitted and are finished off with polished rubber handles. The metal work shows skilled workmanship. In testing the coils, great care is taken by the Messrs. Ziegler, and the wires are thoroughly clamped to the top blocks.

This firm also makes other sizes; their No. 3 is called the combination set, including galvanometer and rheostat. All the instruments of this company are made with the best standard metal and are mounted on hard rubber bases on top of a mahogany box.



An Improved Rheostat.

New York Electric Club.

The Next Regular Meeting of the Electric Club, New York, will occur Thursday evening, November 20th. Prof. E. L. Nicholls, professor of physics at Cornell University, will deliver the address. Professor Nicholls is sure of a large audience, and every attendant will be a thousand times repaid. "The Artificial Light of the Future" will be his topic, and much original work will be presented.

Alfred Sommerguth, Royal Engineer of the Prussian government railways, Berlin, was a Club visitor last week. Mr. S. and friend are looking into the electric railway question in this country.

Messrs. Eddy, Newton and Baird, of the Eddy Motor Company, were Electric Club visitors last week.

F. Z. McGuire, one of the poet laureates of electricity, has returned to New York and the Electric Club, after a sojourn of several weeks at the National capital.

Photographing Water Jets by Electric Light.

Lord Rayleigh, Sec. R. S., describes the apparatus which he had employed for the purpose of obtaining photographs of water jets, the illuminant used being the electric spark, the light of which was diffused by the intervention of a ground glass screen. Under ordinary circumstances, the particles of water composing a jet at some little distance from the nozzle at which it issued were spread out over a considerable area. When, however, a rubbed stick of sealing-wax was brought near, this area diminished, owing to the coalescence of the separate drops on being electrified; but when the jet was more powerfully electrified, the mutual repulsion of the drops was rendered evident by their spreading out over a much greater area. The author explained these phenomena by supposing that in the ordinary unelectrified jet the particles were constantly colliding with one another, and this collisive tendency was so strong that, even when they were all similarly electrified to a slight extent, the usual repulsion was masked by it. Since, however, it was probable that the electrical potential of the different particles varied to a certain small extent, when two approached each other sufficiently closely a spark would pass from one to the other, the effect of which would be to break momentarily the surface film of the drops and allow them to run together. When, however, the jet was more strongly electrified the electrical repulsion would be so great as to prevent the usual mechanical impacts, and coalescence would not take place. Lord Rayleigh exhibited several photographs of water jets which he had taken in the manner described, the exposure, he estimated, being in no case greater than the $\frac{1}{10000}$ of a second.

The Detection of Irregular Working in Machinery.

When a machine goes wrong, the mischief is generally announced by a change or modification in the noise which the working parts normally emit. It is usually inconvenient to stop all the machinery that may be running at the time in order to detect the cause of the irregularity. Yet it is obvious that if only the locus of the unusual noise could be ascertained, or the noise itself isolated from the general burr and clatter going on, much time would be saved, to say nothing of the advantages gained.

According to a recent issue of the *Bulletin de la Société de Mulhouse*, Mons. Rodolphe Bourcart has devised a simple method, by means of which, in the midst of a busy workshop full of machinery in motion, any special noise, even though of insignificant intensity, can be distinguished and its origin traced. In this way even the irregular action of a very small factor in a machine may be discovered.

The apparatus, if indeed it may be designated by such a term, is simplicity itself. It consists of an ordinary india-rubber gas tube about a yard in length; the length may, however, be varied to suit the nature of the investigation. The tube is unprovided with ear-piece or bell. One end is applied to the ear of the observer, whilst the other is moved about in order to explore the seat of the irregularity.

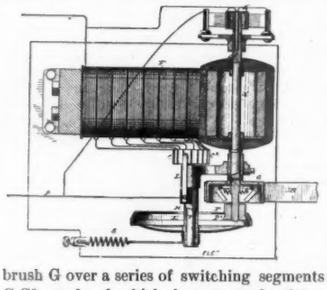
Since the free orifice of the tube is comparatively small and is applied as closely as possible to the vibrating surface, it practically receives only those sonorous vibrations which are emitted by this surface; other vibrations that may be in progress within the room will scarcely affect the ear drum of the observer, who will take care to close his other ear as far as possible.

The "test" tube can be made and used by any one; there is nothing to *learn* about it. Those who have to do with machinery will find it especially useful for observing noises due to irregularities in the working of small parts of machines which may be either difficult or dangerous to approach in any other way.

SOME RECENT ELECTRICAL PATENTS.

IMPROVEMENT IN ELECTRIC MOTORS.

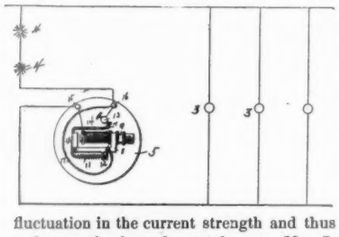
In the accompanying engraving is illustrated a recent improvement, by Prof. Elihu Thomson, in electric motors for preserving their speed under varying loads so as to hold it at a practically constant value irrespective of the amount of work performed. The motor is intended to operate on a constant current circuit, under the control of which a motor, as ordinarily constructed, would speed up on decrease of load and speed down on increase of load. A mechanical device is provided for cutting in or out a portion of the field magnet coils when the load varies. The device is controlled by centrifugal action, the particular form shown in the illustration being a centrifugal governor which will shift a clutch pulley P into or out of engagement with a co-operating pulley E. The latter when moved shifts a



brush G over a series of switching segments C C^2, each of which is connected with a different section of the field magnet coils. A spring S normally draws the pulley E in one direction. The pulley P is maintained in light frictional contact with the pulley E under a normal load. When, however, this contact is varied by a change of load, the wheel E is carried in one direction by the armature operating through the increased frictional contact, or is drawn back in the other direction by the spring S operating by means of a reduction of contact. These actions respectively cut in or out coils of the field magnet system, and thereby vary the intensity of the magnetism and, consequently, the torque of the armature. As shown in the engraving, the field magnet and armature circuits are connected in multiple arc relation, the current splitting at the point marked *a*, and passing through the armature and field magnet in parallel and reuniting at the point marked *b*. The co-operating surface of the friction pulleys are preferably faced with leather.

COMBINED ARC AND INCANDESCENT LIGHTING SYSTEM.

Many efforts have been made to operate arc lamps in connection with incandescent lamps on the same circuit. In cases in which the arc lamps have been placed in series relation to the incandescent system, a change of resistance in any arc resulting from impurities in the carbons, would cause a wide

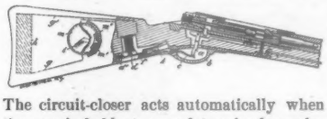


fluctuation in the current strength and thus endanger the incandescent lamps. Mr. J. E. Giles, of Hazleton, Pa., has invented a device by the use of which arc lamps may be grouped in parallel with incandescent lamps on a circuit of constant potential, which is said to insure a perfect operation of both types of lamps, to prevent the arc lamps from creating wide variations of current strength, and to overcome the disagreeable noise due to changes of current strength in the arc branch. The invention is illustrated in the accompanying engraving, wherein 4, 4 represent two arc lamps and 3, 3 a series of incandescent lamps connected between two constant potential mains. At 5 is shown the automatic device for cutting in resistance when the strength of current circulating in the arc branch varies beyond a safe limit, so that an increase of resistance will instantaneously act to preserve the balance of the system, and not only maintain a uniform intensity of the arc lights, but also of the incandescent lights. This disposition should be distinguished from systems in which a broken lamp is replaced automatically by an auxiliary resistance equal to that of the broken lamp, and from compound systems in which are located arc lamps in series relation to incandescent lamps arranged in multiple arc, the whole number of incandescent lamps passing just enough current to sustain the arc lamps and auxiliary resistance being cut in when one or more lamps fail, and from automatic devices—such as regulators—used at the generator to cut in or out resistance to preserve the current strength of the system, irrespective of the number of lamps burning, to avoid great changes of candle-power, and avoid burning out the armature of the generator. The invention relates only to circuits of constant potential in which the arc lamps are disposed in the same relation to the main wires as the incandescent lamps, and the primary object is to prevent a noisy arc.

The automatic regulator consists of an electro-magnet, the armature of which, on a rise of current strength, operates a circuit-breaker and opens a normal low resistance circuit and forces the current to follow a shunt of higher resistance, but which is only a fractional part of the resistance of any one arc lamp. Normally, there are two paths for the current—by way of the contacts and short circuit, and by way of the shunt—but instantly upon rise of current strength the contacts will be separated, additional resistance cut in, and the current strength lowered to compensate the increase due to fluctuation of arc.

ELECTRICALLY-CONTROLLED FIRE ARM.

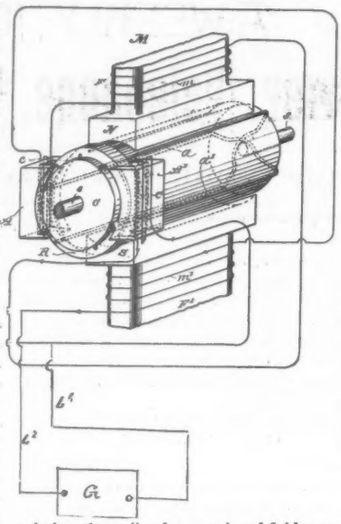
The accompanying engraving illustrates the latest application of electricity to the firing of small arms. In the stock of the gun—a Mauser rifle being shown for example—is placed a cell of dry battery, *h*, the circuit of which includes an electro-magnet, *f*, and a mercurial circuit-closer, *i*.



The circuit-closer acts automatically when the gun is held at a predetermined angular elevation, and energizes magnet *f*, releasing a locking arm, *c*, from the trigger, as will be understood from the engraving. The circuit-closer is a bent glass tube containing mercury, the terminals of the circuit being sealed into the end of the tube. The tube is mounted in a rotary box, *m*, which can be adjusted by means of the pointer and scale to release the lock from the trigger, so that the latter may be pulled to discharge the gun at any desired angle of depression. The gun shown in the drawing can only be discharged on being lowered from an upright position to a horizontal plane, when a drop of mercury will flow into the neck of tube *i* and bridge the circuit terminals; then the latch *c* will be automatically withdrawn and the trigger can be pulled. In any other position, the trigger is locked out of action. The inventor claims that the device replaces in a great measure the sights on a gun, and that it has the important advantage of insuring precision in range and being independent of vision or sight, that it may be employed in many cases for night firing where the range has been previously obtained. For night firing at sappers' heads, also for firing from behind high works, with the gun elevated to a considerable extent, it is claimed to insure great accuracy where the firing would otherwise be at random.

A NEW TYPE OF ALTERNATING CURRENT MOTOR.

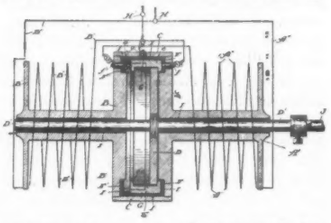
In the accompanying engraving is illustrated a novel type of alternating current electric motor, invented by W. Stanley, Jr., designed to operate under a simple alternating current flowing through a single pair of mains. No commutator is used, rotation being developed by two lines of magnetic polarization developed in an iron armature by the two sets of field magnets placed at right angles to one another. In the engraving, G illustrates a source of alternating current, from which proceeds a single circuit, connecting in series



relation the coils of two pairs of field magnets F F^1 and A A^1, one pair, F F^1, forming a field of force in which an iron armature, C, mounted upon an axis, is located, the other forming a field of force for a copper ring or conductor, R, carried by one end of the iron armature but suitably insulated therefrom. The armature conductors have their terminals secured in the copper ring R at diametrically opposite points, as indicated in the engraving, each coil terminating in the ring at one end and bending over the end of the armature at the other. The field magnets, A A^1, under the influence of a current passing through their exciting coils, are polarized, and induce currents in the ring R, and the two magnets are so wound that the currents will oppose one another in direction in the copper ring, thus causing them to join in parallel, and pass over the armature conductor from one side of the ring to the other. From this it will be understood that any given phase of current circulating over the mains will develop currents in the copper ring which will circulate through the armature coil located at the neutral point of inductive effect, or through the vertical coil shown in the drawing. This current will tend to polarize the armature in a direction at right angles to the polarity impressed upon the armature by the field magnets F F^1, and the two forces combined will create a consequent pole on a line some where between the two, which will be attracted by the field-magnets N S and create a rotary torque in the armature. As the armature rotates, the copper ring R will be carried with it and the terminal of another armature coil will be brought into position of maximum effect in magnetizing the armature. Inasmuch as a reversal of current will effect both sets of field-magnets alike, the direction of rotation will be constant. The field-magnets and armature will be laminated as usual in the construction of alternating current machines. The armature conductors will preferably be made of copper bars lying longitudinally along the armature core. As illustrated in the engraving, the circuits of the two sets of field-magnets are shown as connected in series; they may, however, be connected in multiple arc relation without interfering with the mode of operation described. It is evident that when the armature is in rotation an opposing electro-motive force will be developed in such conductors as are in inductive relation to the field-magnets F F^1, and this opposing force will cause the currents developed in the copper ring to select as their path that armature coil or conductor, which, if the armature were at rest, would not be inductively acted upon by the establishment of a field of force from F to F^1.

ELECTRIC DRILL.

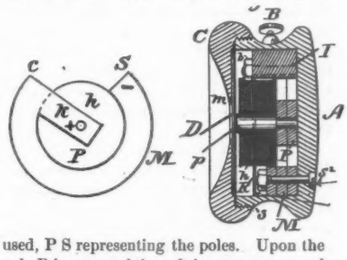
In the accompanying engraving is illustrated an electric drill, invented by Gordon Buchanan, of Chicago. The drill is operated by being interposed in the circuit of any source of direct current, a dynamo being preferred. It involves as its operative parts two coils wound upon iron spools, the flanges of which face each other, between which flanges is placed a plate armature, marked D in the engraving, fastened to the drill-stock. An annular flanged ring, marked E, surrounds the armature disk and is adapted to slide between two binding-posts *f* f^1. One of these binding-posts is connected with the terminal of one coil, and the other binding-post with the terminal of the other coil. The flanged ring E is in continuous engagement with a band of conducting material G surrounding it, which band is connected by means of a binding-post *g* with the one terminal of the circuit. This arrangement permits the armature to make almost a full stroke before the circuit is commutated, so as to act on the opposite coil; for example, in the position illustrated in the engraving, the current would pass from terminal H', to binding-post *g*, to the ring, circuit-closer, binding post *f* and through coil B", to the other terminal H of the dynamo; the iron head or flange of the spool B thus being magnetized will pull upon armature D and its exciting



coil will not be cut out of circuit until the armature has made its full stroke, when ring E will be forced out of contact with *f* and into contact with *f'*, thus opening the circuit of coil B" and cutting in coil A". A reciprocatory motion is thus imparted to the drill.

IMPROVEMENT IN TELEPHONES.

In the accompanying engraving is illustrated an improvement in telephones, recently patented by W. L. Richards, of Malden, Mass. The invention is applicable principally to small telephones, in which in order to reduce them in size so as to occupy little space, the permanent magnet is curved or coiled. This shape of the magnet results in an irregular distribution of the lines of force developed by said magnet and a scattering action upon the diaphragm, causing indistinct articulation in receiving or transmitting speech. The point to the invention will be understood by an inspection of the accompanying engraving, in which in Fig. 1. is illustrated the form of permanent magnet



used, P S representing the poles. Upon the pole P is mounted the soft iron core *p* wound with a helix connected to line. The inventor has found that the cause of the indistinct articulation exists in a flow of the lines of force from other points than the point P toward the pole S, and in order to concent trate them upon the pole-piece *p* so as to act upon the center of the diaphragm, he places a ring of ferrotype iron R over the permanent magnet but magnetically insulated therefrom. This ring acts as a protecting sheath to the diaphragm by affording a path for the lines of force which tend to proceed from the magnet to the outer portion of the diaphragm, thus causing them to flow where they will be most useful in reproducing or transmitting speech.

World's Fair News.—Chairman Sims' Plans.

Col. Gardiner C. Sims, of Providence, R. I., recently gave out the following letter to the Chicago papers for publication. After saying that he is being deluged with applications for the position of chief electrician, Mr. Sims says:

I have not in any way committed myself, as I realize the existence of a local board, with which we will in no way conflict, but will work in harmony. I have in mind, however, a person for the position of chief electrical engineer. He has not made application, nor do I know that he will accept if the position is offered to him. He is a practical mechanic, but has been interested in electrical development from its commencement as a commercial success, and is thoroughly familiar with its progress to the present day, as well as with the arrangement of all electrical exhibitions that have been held. He now occupies an excellent and commanding position in one of the largest and most prominent electrical companies in our country.

From a practical standpoint, our committee has in mind four things of vital importance: First, to prevent loss of life; second, to prevent injury to person or creature; third, to prevent the destruction of property by fire, and lastly, to make an unqualified and satisfactory success of our department, which we hope the committee on classification will make separate and distinct.

To accomplish this result I desire the services of such a person as I have described.

Our committee has elected for its permanent secretary Commissioner Martin Ryan, Fargo, N. D., a lawyer of ability, and a man of considerable electrical experience in his younger days. I would respectfully submit the following suggestions for consideration of the executive committee:

It is my purpose to show the advanced state of the art of transmitting power, from the Centennial of 1876 to the present time. You will remember that motive power was then communicated from engines to lines of shafting, having pulleys, hangers and couplings by belts, ropes, etc. I would respectfully suggest that a large building be constructed that shall contain engines, boilers, condensers, pumps, heaters and commercial dynamos. During the exposition, anthracite coal for generating steam could be used, which would prevent smoke, a nuisance that is prejudicial to the future growth of Chicago, and must, sooner or later, be abated. There are many smoke-consuming furnaces and practical devices for the consumption of smoke that could be used, and if a competitive trial was demanded it could easily be accorded the many representatives, allowing the general public to constitute itself a jury of award, judging by the amount of solid matter that will leave the various smoke chimneys, to deposit itself, in a measure, in every house in Chicago. Let it be said that the exposition does not contribute to this objection and assist in injuring the exhibits of our guests that kindly favor us.

From the power and electrical generating stations the electrical current should be taken and distributed to its objective point by an underground system or systems, and then by concealed insulated wires to motors that are to drive the various machines.

In contemplating such a gigantic undertaking it is not to be expected that electric corporations could contribute more than their special exhibits, for which motive power must be furnished gratuitiously; yet, by adopting an advanced plan of transmitting power, you would save, let us say, $750,000, by the absence of shafting, belts, etc. This amount could be invested in electrical equipment by the exposition, which they would sell for about 75 per cent. of its cost, while the exposition was officially open, to be delivered to the purchaser where it stood within ten days after its close for strict cash.

The plan for transmitting motive power cannot be carried out in its entirety, as isolated casesewill arise which will prevent. It will also meet with some opposition from the builders of steam engines, yet it will have the approval of those advanced ideas, as it does of many of my associates who have kindly given their indorsement.

As the primary object of the fair is educational, let our visitors have an ocular demonstration how the busy wheels of manufacture can be made to run in the immediate neighborhood of their homes without steam engines, smoke, the noise and dirt of coal carts and liability of boiler explosions, also turning into use and gain much valuable real estate and buildings in central business districts now occupied as steam power stations.

All railways for the transportation of passengers should be electrical and elevated, with frequent stations. The excess of revenue derived will equalize the deficiency of other departments of our bureau which cannot be made self-sustaining.

A demand will be made that it will be necessary to have special steam engines and dynamos in the electrical building for special exhibits. This we will cheerfully accede to. The engines, however, must be made to run without steam, which can easily be done by electricity, so as to avoid the smell of oil and radiation of heat from steam and exhaust pipes, which would make our building unbearable to multitudes, even were the temperature not to be compared with June and July weather of this year.

We would also like to practically illustrate the manner in which a ship that had met with injury to her hull could be temporarily, and possibly permanently, repaired without going into a dry-dock, beaching or on launching ways, or in mid-ocean, weather permitting, by the aid of electrical and mechanical appliances, of which every ship should have an outfit.

I have partially outlined a general plan, the details of which are not now necessary, but will come up later for discussion and approval.

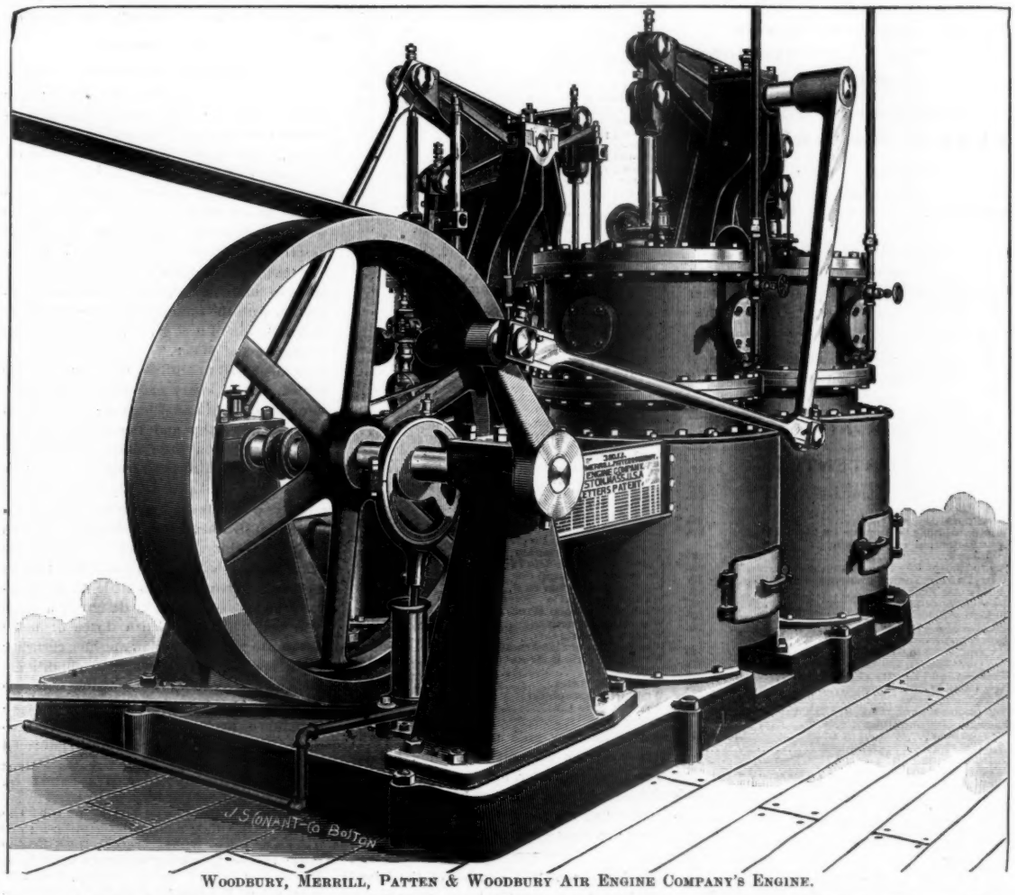
We propose to call to our aid, in an unofficial way, as well as invite suggestions from, the leading electrical engineers of our country, as we have no set plan of procedure as yet, and will not have until directed by the executive committee and director-general.

I have no bill of expenses to present, and have authorized no expenditure whatever in behalf of our committee.

Respectfully yours,

GARDINER C. SIMS,

Chairman of Committee on Electricity, Electrical and Pneumatic Appliances, World's Columbian Commission.



WOODBURY, MERRILL, PATTEN & WOODBURY AIR ENGINE COMPANY'S ENGINE.

A New Air Engine.

Hot air engines have puzzled many minds. They have always been thought a good thing, especially when the coal consumption could be held down. We illustrate on this page the latest development in this line. This engine has been creating a great deal of talk in Boston, where it has been on exhibition at the Mechanics' Fair. It has an unique appearance.

The inventors claim that only 1.5 pounds of coal per horse-power per hour is used.

The engine is composed of two reversers and two double-acting working cylinders. Each reverser is provided with a heater placed within a furnace; a regenerator composed of wire cloth of great superficial area, extending from the cooler to the bottom of the heater; a cooler composed of a large number of thin copper tubes, which are surrounded by water, and a displacer piston adapted to reciprocate within the cooler. Each reverser is connected by means of pipes with the working cylinders in the following manner: The hot chamber below the displacer piston is connected with the bottom of the working cylinder directly opposite, and the cold chamber above the displacer piston is connected with the top of the working cylinder diagonally opposite. A small air-pump operated by an eccentric on the main shaft is used to compress the air to the initial pressure, which is subject to loss, as about 15 per cent. of the air escapes around the pistons. The speed is regulated by a valve in an equalizing pipe, which connects the top of the working cylinders together, the valve being operated by a common centrifugal governor.

The alternate raising and lowering of the temperature of the air is accomplished thus: In the upward stroke of the displacer piston, the air in the cold chamber above is forced through the cooling tubes and down into the regenerator, in its passage through which it absorbs heat which has been imparted to the regenerator. The air then passing over the surface of the reverser heater becomes further heated, reaching a temperature of about 600° F. and enters the hot chamber below the displacer piston. In the downward stroke of the piston, the air is forced through the regenerator, disposing, during its passage, of a great part of its heat, thence through the cooling tubes, where the temperature is reduced to about 120° F., into the cold chamber above the displacer piston. As the reversers are in duplicate, the displaced air in one is being heated while in the other reverser it is being cooled.

The alternate raising and lowering of the temperature of the displaced air develops power in the working cylinders, as follows: When one displacer piston is making its upward stroke and heating and expanding the displaced air, a pressure is exerted against the bottom of the piston of the working cylinder directly opposite and against the top of the working cylinder diagonally opposite; the other displacer piston is making the downward stroke and is cooling and contracting the displaced air, thereby reducing the pressure against the bottom of the piston of the working cylinder directly opposite and the top of the piston of the working cylinder diagonally opposite. The engine is designed to run on an initial pressure of air of about 45 pounds at a speed of 115 revolutions per minute.

The engines are built by the Woodbury, Merrill, Patten & Woodbury Air Engine Company, which is capitalized at $1,000,000. The officers of the company are: James A. Woodbury, president; Joshua Merrill, treasurer; Hiram L. Goodrich, clerk, and E. Frank Woodbury, constructing engineer. The company's offices are at 8 Exchange Place, Boston.

Council Bluffs, Ia.—Iowa Fuel and Power Company; capital, $25,000.

Fairfield, Ia.—Fairfield Gas and Electric Company; capital, $50,000.

Sioux City, Ia.—Leeds Electric Railway Company; capital, $250,000.

Sioux City, Ia.—Sioux City Electrical Supply Company; capital, $10,000.

Pokomoke, Md.—Pokomoke Electric Light and Power Company; capital, $10,000.

Saginaw, Mich.—The Murray Overhead Trolley Switch Company; capital, $50,000.

Curwensville, Pa.—The Curwensville Light and Power Company; capital, $16,000.

Denver, Col.—Thirty-fourth Avenue Railway and Electric Company; capital, $50,000.

Council Bluffs, Ia.—The Avoca Electric Light and Power Company; capital, $10,000. Directors, H. O. Seiffert, G. Diederich, Fremont Benjamin, J. H. Jenks, N. D. Sanford, Charles N. Voss, J. J. Hepsley.

Helena, Mont.—Union Electric Railway Company; capital, $500,000. Incorporators, Newton M. McConnell, Albert M. Thornburgh, Edgar C. Richards, George B. Hopkins and John B. Clayberg.

San Francisco, Cal.—The American District Telegraph and Messenger Company; capital, $100,000; directors, H. G. Platt, W. D. Mansfield, I. W. Thorne, William F. Greenebaum and J. T. Fleming.

Baltimore, Md.—The Maryland and Columbia Telegraph Company; capital, $50,000. Incorporators, Thomas C. Chappell, James S. Hagerty, Levi Z. Conden, Robert Crain, Wm. G. Scarleft; James H. Preston, Wesley M. Oler, Albert F. Horner, Lawrence B. McCabe, John M. Van Bibber and Theophilus Tunis.

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The REVIEW goes to press a day earlier this week on account of election holiday. The electrical fraternity, after exercising the right of suffrage, will thus have the privilege of devoting the rest of the day to reading the latest and most important electrical news.

It is reported that another of the islands off the Atlantic coast is to be connected by submarine cable with the mainland. An English company is said to have submitted a proposal to lay a cable from the Florida coast to Nassau, if an annual subsidy is granted by the colony. It is expected that the Nassau legislature will accept the proposition.

A gentleman prominent in electrical circles who has just returned to New York, from an extended trip in the West, expresses his sentiments thusly: "In the matter of electrical progress, this great metropolis is way behind the times. We have just one electric railroad here, the Fourth avenue storage battery line. Take electric lighting. Chicago, Cincinnati and St. Louis are far better illuminated than New York. There is too much politics in electric lighting here. Of course, the telegraph and telephone systems of New York, will compare favorably with any in the world, but as for electrical development in general, New York is like the man on the cab—not in it."

Electric traction is progressing with such phenomenal strides that, at the present rate of development, there will soon not be a surface railroad in this country operated by any other means than electric motors. No branch of electrical industry has had such a rapid growth as electric traction, and certainly none other has such a prosperous future in prospect.

We commend the readers of the REVIEW to carefully peruse the illustrated article on important electrical patents published regularly in this journal. It will enable them to keep step with the rapid march of this progressive art. The Patent Office is the place where the news of any improvement is first reported. We endeavor to give in the description of each patent noticed a clear idea of the invention and yet bring it within the compass of a paragraph, so that the entire article, treating of the week's progress of the art, may be read in a few minutes. It would be wearisome to the reader to wade through a description of every electrical patent issued, as, of course, the greater number relate to improvements in details. Only such as seem to mark a distinctively new step forward, or have some clean cut features of novelty, are therefore mentioned.

BRIDGING BELLS.

In the London *Electrical Review* for October 17th, we find a short editorial commenting on the address given by Mr. J. J. Carty, at the recent telephone convention, on the subject of Bridging Bells for telephone lines containing several stations. The article in question says that "the speaker seemed to be quite unaware that the method described had been for many years in use on the telephone systems worked by the post office in this country, and all details in connection with the same carefully worked out. A description of it is given in *The Telephone*, by Preece and Maier."

In his haste to criticise, the writer in our British contemporary clearly wrote under a misapprehension and if he had examined his Preece and Maier and the report of Mr. Carty's address a little more carefully, he would have avoided falling into such evident error. The speaker distinctly stated that no novelty was claimed for the *method* of connecting instruments "in bridge," as he was aware that this method had been in use for years, both at home and abroad, but that to meet certain requirements made on his company he had succeeded in designing a magneto bell which enabled a dozen or more stations to be connected on one line, ensuring good speaking and ringing conditions. Such an arrangement is impossible with the ordinary form of magneto bell and in the construction of the bell lays the novelty or invention. That it is a novelty is amply confirmed by the fact that the United States Patent Office has virtually allowed a patent on Mr. Carty's improved form of bell.

As regards the use of the system by the British Post Office and its description in *The Telephone*, we would refer the *Review* critic to the following passages in Messrs. Preece and Maier's work. On pp. 180, 182, speaking of "Magneto Signals," the following paragraph occurs: "Magnetic call signals have of late years come greatly into favor for telephonic purposes. They doubtless furnish a very convenient source of electric energy; but some administrations—notably the British Post Office—considering that the adoption of the microscopic transmitter already entails the employment of a battery, and for other minor reasons, have not adopted them."

On page 202 of *The Telephone*, there is a reference to telephone instruments connected "in bridge," and a description follows of an intermediate switch for use on such circuits; but both the description and the diagram (Fig. 128) show clearly that electric, and not magneto, bells are employed. The chapters, three in number, devoted to the subject of "Several Subscribers Placed on One Circuit," contain no reference whatever to any system of bridging bells, and almost all the methods described employ electric bells in connection with more or less complicated switching devices.

It is pretty clear to us that if the bridging magneto bell has been in use by the British Post Office "for many years," no description of it has been published, and certainly no reference to any such system occurs in *The Telephone* by Preece and Maier.

ELECTRICAL ACCIDENTS.

An unfortunate combination of circumstances has been the cause during the past year of imbuing the public mind with a very lively sense of the dangers of electricity. There is, undoubtedly, some foundation for this feeling; that it should have been emphasized so frequently of late by fatal accidents is much to be regretted; that these accidents should have formed the excuse for an exchange of polemics between rival electricians of eminence and for much inaccurate writing in sensational newspapers, is also greatly to be regretted.

Electricians all over the country have a grave responsibility upon them. They are dealing with a force which, having many problems for even the most learned scientists, is, for the vast majority of men, a mystery almost as impenetrable as the spiritual world. It is incumbent, therefore, upon electrical men to generate and distribute this "imponderable matter," which to-day performs so many services for mankind in such a manner as to secure the most absolute safety for both consumer and producer; apart from the question of the safety of the public, which is too often given scant consideration by powerful corporations, electrical men neglect their best interests in not straining every point in favor of safety. Every electrical accident accentuates the public fear of electric currents all and sundry, and this feeling cannot fail to produce an unfavorable effect on the prosperity of electrical industries, either in tying up the purse-string of capitalists, or the withdrawal of custom, or both.

Electrical men are doubly unfortunate in that not only have the public acquired an unsatisfactory mistrust of electrical apparatus and wires in general, but the newspapers give such prominence to every electrical mishap that this feeling of insecurity is fanned and fed morning and evening, week days and Sundays, by the moulders of public opinion. It is a trite saying that what in an officer is merely emphatic language becomes rank blasphemy from the tongue of the private in the ranks. In the same way, railroad corporations are allowed to kill and maim their employés and passengers by the score, and after the first blood-curdling account of the horror, little or nothing more is said of the matter. But let an unfortunate lineman be killed or hurt by an electric current, and a howl of indignation is kept up for weeks in the daily press, accompanied by a demand for the indictment for manslaughter of one or more officers of the offending company.

Within the past two months—writing from memory—not less than 50 people have been killed—and at least twice that number more or less seriously injured—by "accidents" on the lines of various railroad companies in this country, and yet we fail to find in the daily papers any very urgent demands for the indictment of the president, superintendent, or any other officials of the offending corporations. Here we find a greater sacrifice of human life accomplished in less than two months, on a very limited number of railroads, than can be charged to the electric current during the entire period of its commercial history as a source of light and power. On the other hand, an unfortunate lineman meets his death on a pole in New York City, how and why it is not necessary to discuss here, and the horror of his ending is thrust before the eyes of the public with far more persistence than is deemed necessary in regard to the far more terrible railroad disasters mentioned above. The different treatment meted out to steam and electricity in this matter of accidents is curious, to say the least of it, but the injustice of it must have struck every electrical man just as it strikes us.

At least, electrical corporations should be credited with the fact that they only kill one man at a time and do not hustle a score or so of human beings into eternity *en bloc*, like the railroad companies.

The question to be met fairly and squarely by every man in the electrical business is the prevention, by every means in his power, of electrical accidents, large and small. The injustice of newspaper comment need affect us little or not at all; every young industry has had to submit to the same kind of treatment and outlive it, just as electricity is bound to outlive all unfavorable comment.

CORRESPONDENCE.

OUR WASHINGTON LETTER.

The President has Appointed Professor Henry A. Rowland, of Johns Hopkins University, Baltimore; Andrew Rosewater, of Omaha, Neb., and Lieut. Francis R. Shunk, Corps of Engineers, U. S. A., as members of the electrical commission for the District of Columbia. This commission was authorized by an act of Congress, passed at the last session. It is required to investigate all questions relating to the use of electric wires in this District, both by the government and private companies, and to report upon some plan for their construction and maintenance, not later than December 1, 1891. Lieut. Shunk is regarded as one of the most capable young officers in his corps. He graduated at the head of his class, at West Point, in 1887, has since that time spent three years in the engineering school at Willets Point, and is now assistant instructor in submarine mining at that place. Mr. Rosewater is a brother of Edward Rosewater, the editor and proprietor of the Omaha *Bee*, who is universally known to the electrical fraternity as an old time telegraph operator. He is a member of the American Society of Civil Engineers, has been the city engineer of Omaha for 10 years, and is identified with various extensive municipal and railroad engineering works. Professor Rowland's position and ability need no mention.

The Commissioners of the District of Columbia have published a very formal and official announcement that they desire to receive proposals for supplying gas and electric lights for municipal lighting, upon annual, five-year, and ten-year contracts, and upon any system. In doing this they are performing a duty required by act of Congress, but it is not intended that any awards will be made, no matter what proposals may be received. The sole object of the legislation, and of this advertisement, is to obtain from lighting companies information which will be useful to Congress in the future. The lighting contract for the current year has been made; there is no authority for making another contract, and it is doubtful whether any new company would be allowed to commence business, even if it had a government contract. About a year ago a company representing the Westinghouse interests secured a contract for street lighting from the Commissioners, and commenced running wires, but were enjoined. The lower court has recently decided against the power of the Commissioners to make any such contract, and the case has been appealed to the Supreme Court of the District. Several years ago a newly appointed officer at the head of one of the departments issued a schedule of goods, containing two or three thousand items, and requested bids from dealers. One of the most prominent manufacturers of electrical goods went to much trouble and expense to get the lowest possible prices and prepare a formal bid, with the usual guarantees of financial responsibility, etc. On the day appointed for opening the bids he sent an agent to ascertain what items were awarded to him, and was coolly informed by the government official that "he did not want to purchase any goods, he was merely finding out who manufactured them and what they cost." This is a specimen of governmental eccentricity which, unfortunately for contractors, is not rare.

Preparations for the Transfer of the weather reporting bureau from the Army Signal Office to the Agricultural Department, on the 1st July, 1891, are in progress. This change, being intended especially for the benefit of agricultural interests, will naturally lead to some extensions of telegraph lines, to points not reached by commercial lines, and there will probably be need of a small number of additional operators. The telegraph, telephone and flag signal service will remain as one of the departments of the army, and being independent of meteorological work, will grow in importance and extent.

Tatoosh Cannot Have a Cable because the new tariff law prohibits the importation of any foreign manufactures for government use without payment of duty. Heretofore the Signal Office has had the advantage of free admission for all the English cables, wires and other telegraphic material it needed and its estimates for this year were based upon the expectation that the same rule would prevail. There seems to be a misapprehension on the part of the government officials that, while American factories can make well insulated conductors for submarine use, they do not use armor wires sufficiently well galvanized to stand the prescribed tests.

Baking Powder vs. The U. S. Government.—O. D. Ladow, secretary to the secretary of the Agricultural Department, will go to New York city on the 15th of November to take the position of advertising agent for the Royal Baking Powder Company, at a much higher salary than the government can afford to pay. Ladow is the inventor of the mechanical transmitter which will send clear, solid "Morse" as fast as the most expert typewriter can copy it.

"The Hubbell Electric Light and Power Company, of the District of Columbia."—The same old racket. A body corporate, with no end of heavy capitalists, and a primary battery with a pungent smell of sulphuric acid. This is the fifth primary battery scheme that has been launched in this neighborhood within 12 months.

A Board of Army Officers has been appointed to meet in this city for the purpose of testing range and position finders.

Personal.—Lieut. Hamilton Hutchins has been assigned to duty as an assistant to the superintendent of the Electric Lighting Bureau in the Navy Department.—Thomas Ewing, Jr., first assistant examiner in the Patent Office, who has had charge of fire telegraphs and signaling, has resigned his position to engage in business as a patent attorney in New York, and the vacancy has been filled by the transfer of J. H. Brickenstein from the metal working division of the office.—Mr. J. H. Dowell, assistant to the Examiner of Interferences in the Patent Office, has left the service of the government and joined the firm of Butterworth, Hall & Brown. He will be located in the Washington office of that firm. While in the Patent Office he had occasion to investigate many important electrical cases and has many acquaintances among electrical men.

A Sharp Contest has arisen between the Gamewell Company and the Municipal Signal Company over the question of a contract for equipping two police precincts with the patrol telephone system. Both companies claim that their respective systems are the best and that their prices are the lowest. The matter will be referred to the new commission.

The United States Electric Lighting Company is having a very extensive system of underground conduits laid in the northern part of the city by Mr. Wilmot Lake, of the Terra Cotta Conduit Company. It is taking advantage of a recent decision of the District authorities authorizing this work, to secure a foothold which will enable it to largely extend and increase its business. The uncertainty regarding the result of the investigation to be made by the newly appointed commission, renders this of much importance.

Attorneys representing the State of New York have appeared before the Supreme Court with a motion to advance the case of the Japanese, Jugigo, who now stands at the head of the electrocution class. It is expected that the court will, on the 4th of November, fix an early day for the hearing, unless the case should be peremptorily dismissed. The matter is a repetition of the Kemmler case, Attorney Sherman claiming that his dramatic predictions of torture and tragedy were more than fulfilled, while the executioner and the doctors own up to having been badly scared and admit that the job was done in a very bungling manner, but believe they can do better next time. The court having once decided that the law under which Jugigo has been sentenced is constitutional, and that electrocution is a practical and proper method of carrying it into effect, the outcome seems plain. G. C. M.

Washington, D. C., Oct. 29th, 1890.

OUR CHICAGO LETTER.

The Central Electric Company are to be congratulated upon the acquisition of Mr. George W. Vernor, who takes charge of the book-keeping department. Mr. Vernor has been secretary of the Southern Electrical Supply Company, at St. Louis, for the past year, and is already well known to the electrical trade. Mr. Charles E. Brown, of the Central Electric Company, has just returned from an extended trip of over eight weeks duration. Mr. Brown reports business good, and brings home some nice orders for improved Candee wire. This company's new fixture and electrolier department is now complete and adds materially to the showy appearance of their already handsome store.

Mr. N. S. Possons, the well known superintendent of the Brush Electric Company, of Cleveland, will hereafter reside in Chicago. He will be general manager of the Belding Electric Motor and Manufacturing Company, a company that now has a capital of $2,000,000 and is moving into an immense new factory. They will manufacture on a very large scale. D. B. D.

Chicago, Nov. 1st, 1890.

Insurance men of other cities have often expressed in forcible terms their disgust at the old fogyism prevalent in New York insurance circles. What can be expected of alleged inspectors of risks and other officials whose most wearing task is the holding down of a revolving office chair? What better example of senile conservativeness, or arrogant arbitrariness, can be exhibited than the action of a Board of Fire Underwriters which adheres to a rule made a quarter of a century ago, and which now virtually means that a building lighted with oil lanterns is a safer risk than one illuminated by the incandescent electric light?

Underground Electrical Work.

At the last meeting of the Chicago Electric Club, Mr. Fred. E. Degenhardt read an interesting paper on "Underground Electrical Work." He said:

To Charles Augustin Coulomb, no doubt belonged the honor of discovery of that most essential necessity of modern electricity, insulation.

He found that a thread of gum-lac was the most perfect of all insulators, as that it insulated ten times as well as a dry silk thread, and that a silk thread covered with fine sealing wax insulated as powerfully as gum-lac when it had four times its length.

He found that the dissipation of electricity along insulators was chiefly owing to adhering moisture, but in some measure also to a slight conducting power.

In 1829 Prof. Henry used insulating wire for experimental work.

It was during the year 1832 that Prof. Morse first conceived the idea of underground transmission of electricity, and among his earliest plans we have a suggestion of the conduits of to-day.

Prof. Morse's first cable was laid from Baltimore to the Relay House, seven miles distant, and the failure of this cable all but sealed the fate of underground electrical work.

The first overhead insulation adopted on the line built by Prof. Morse, shows how rudimental were the conceptions of men at that period. The insulation consisted simply of two plates, of glass, between which the wire, after wrapping well with cloth saturated with gum shellac, was placed, and over which a wooden cover, to protect from rain and press the glass upon the wire and keep it in place, was nailed.

It is safe to say that underground work slumbered for a period of 20 years, from the date of Prof. Morse's first experiments.

When in the city of Chicago an objectionable pole line had been placed through a prominent residence portion of the city, the citizens of that particular section banded themselves together, and selected a committee who waited upon Prof. Barrett, of the City Telegraph Department of the city of Chicago, and stated their grievances.

The Professor told them that the line might be placed underground, but that the city did not furnish the means for so placing it. After momentary deliberation, the gentlemen composing the committee volunteered to defray the expenses, and the poles were removed, and thus the first underground work was started in the city of Chicago.

Eight hundred and forty feet of two inch wrought iron pipe was laid about three feet below the surface, the exterior of the pipe being first treated with a liberal amount of tar and linseed oil. In this pipe two insulated wires were placed. These wires are in service to-day, and are giving as good service as the day they were placed underground.

From this date on the underground question was agitated in the city of Chicago, and in the year 1883, the common council passed an ordinance requiring all electric conductors to be placed underground.

In accordance with this ordinance, the various companies doing business in the city, after exhausting all means to evade it, adopted various systems for placing their wires underground, and to-day the wires so placed underground embrace all branches of the service, viz., telegraph, telephone, police, fire alarm, electric lighting and power.

In 1883, a franchise was granted to the Sectional Electric Underground Company to build underground conduits for commercial purposes. This company built about seven miles of conduits in the business district of the city, and rented space in the same for $1,000 per mile per duct per year, the city being allowed the use of one duct free of charge.

The cables laid underground in the city of Chicago are placed in conduits of various kinds, viz., iron pipe laid in the earth without other protection; iron pipe laid in concrete; iron pipe, cement lined, laid in concrete and multitubular blocks of bituminous concrete about four feet long.

Manholes in many cases are built circular in form, and in other cases rectangular shaped, the latter averaging 46 inches in length by 40 inches in width, and are from four and one-half to nine feet deep, with double iron covers, one of which is set below the grade and made water tight by packing, the other set on a level with the street.

The iron pipe used for conduit is thoroughly reamed at the ends, thus removing the burr. Conduit is laid with a pitch of difference of grade from six inches to one foot, so as to draw into the manholes, thus disposing of all drip from condensed moisture.

The usual specifications for underground conductors for the purposes of arc lighting may, perhaps, not be out of place, and I give them herewith:

The insulation resistance should not be less than 500 megohms per mile, and the insulation should not materially deteriorate for the space of two years after being in service on an electric light circuit having a voltage of from 2,500 to 3,000 volts, and a current of from 9 to 12 amperes, or a voltage of from 900 to 1,200 volts and a current of from 18 to 20 amperes.

The early method of preparing the trench for underground work was to plough a furrow, and place the conduit and the insulated wires in the trench thus made. To-day the tools and accessories are quite a feature of underground work, for after the conduits have been made and the ducts placed in most perfect alignment, so that no obstruction may be offered to the introduction to the cables, a competent corps of men take charge of the drawing in of the cables into the ducts, and I have prepared some sketches of the most essential tools, which I show in this drawing.

Moisture is to-day, as it has always been, the worst enemy of perfect underground construction, and, therefore, in selecting men for the difficult work of making joints, it is well to secure those men who are possessed of that sovereign virtue, sobriety, and instill into their minds the fact that it is not how many joints they can make, but how good they can do them.

Electrical currents of infinitessimal potential are no more easily conducted than are those electrical giants of 4,000 or 5,000 volts.

To-day the user of the cables for electric lighting, simply tells the manufacturer of the potential that he wishes to carry over his lines underground, and lo, the cable is forthcoming and with it a guarantee.

The telephone manager tells you that he must have a cable with an electro-static capacity that must not exceed a given number of microfarads and that it must contain so and so many conductors, and that its insulation must be so high and no higher, that all the conditions must be delivered within a given space and the wires must be twisted in pairs, so that they can be formed into a metallic circuit if they wish, and your manufacturer goes at once to work and evolves a cable that meets these most exacting requirements.

Thus on, through the whole list, transmission of power, telegraph, arc or incandescent lighting, it matters not, you simply make known your wants, aye, even whisper them, and 20 bright and active workers stand ready to take your orders and deliver the results you desire.

Pardon my return to statistical information, but in the progressive city of Chicago alone there is at present in successful daily operation the following enormous amount of underground electrical cables and wires, the telegraph companies alone using no less than 650 miles of wire:

The Chicago Arc Light and Power Company operate 140 miles of arc light cable and 30 miles of ducts. The city of Chicago 174 miles of arc light cables, 1,264,430 feet of conductors, made into cables from 5 to 25 wires each, and 65 miles of single wires. The city has 20,441 feet of conduit, or about 100,000 feet of ducts otherwise than of iron pipe, and of the latter they have 478,087 feet used for conduits.

The Chicago Telephone Company have in operation at this date 6,080 miles of wire, in the form of cables, or 32,102,400 feet of conductors. Their conduit system consists of 67,175 feet of main conduit, in which are 192,786 feet of duct. These conduits have a carrying capacity, when full, of 1,000,000 feet of cable of 200 conductors. In addition to the above, they have lateral conduits which measure 7,451 feet, and duct capacity in these laterals of 8,004 feet, and a cable capacity of a like amount.

The Chicago Edison Company has 90 miles of conductors.

The Pacific Cable Again.

In Australia there is doubtlessly a general feeling just now that an alternative line of telegraphic communication with the rest of the world is an imperative necessity. There are at present three cables between Australia and Java, two from Port Darwin and one from Roebuck Bay, all three converging to a common landing place at Banjoewangie. A short time ago the three cables were broken down simultaneously and Australia and New Zealand were telegraphically cut off from the rest of the world for nine days. The cause of the ruptures was found to be a submarine earthquake which occurred a short distance from Banjoewangie, and therefore affected all three cables, doing so much damage that the first cable repaired was found to be broken in three places within 65 miles of the landing-place. These sudden upheavals of the ocean bed occur somewhat frequently in the Java seas, and the cables have been broken from the same cause more than once. The Australians do not at all appreciate the risk of being cut off from "the swift current of the world's affairs" from time to time in this manner, and their last experience will no doubt incline them to think seriously of the Pacific cable scheme that has been talked of so long, and the realization of which will afford Australia and New Zealand perfect immunity from interruptions to their telegraphic communication with the rest of the world.

*** The English telephone patents expire on December 9th.

*** The long distance telephone between Erie, Elmira and New York, was tested last week and worked successfully.

*** The linemen of the New Brunswick Telephone Company are busy planting poles for the wires to join the Nova Scotia Company, at the provincial boundary, thus making it possible to speak directly from Halifax to Fredericton.

Telephone Men of the South in Convention.

THE SUPERINTENDENTS AND MANAGERS OF THE SOUTHERN BELL MEET AT MACON, GA.

A convention of the superintendents and managers of the Southern Bell Telephone Company was held in Macon, October 22d. The convention met at 9 o'clock in the morning at the office of Superintendent Easterlin in the telephone exchange on Second street. There were in attendance most of the superintendents and managers of exchanges, and matters of importance to the telephone service were discussed.

Mr. David I. Carson, of New York, general superintendent of the Southern Bell Telephone Company, presided at the convention with the grace and ease of an old presiding officer. The division superintendents who attended were C. E. McClure, of Richmond, Va., and John D. Easterlin, of Macon.

The telephone exchanges were represented by the following managers: Cole and Gentry, of Atlanta; Rood, of Savannah; Crews, of Norfolk; Torbet, of Charleston; West, of Birmingham; Ingraham, of Columbus; Mullenix, of Macon; Murphy, of Augusta; Watson, of Mobile; Polk, of Montgomery; and Black, of New York. There were also present: Manager B. F. Dillon, of the Jacksonville Exchange, who is best known as superintendent of the fifth district of the Western Union Telegraph Company; Electrician Wotten, of Atlanta, and Electrician Fogie, of Macon.

Papers were read by several on matters of general interest to telephone men. The proceedings were not public, as the convention was considered more of a personal business meeting than otherwise. It is known, however, that the chief topic of discussion and one on which more than one paper was read, was the training of inspectors for the purpose of improving the service. The importance of employing good local inspectors was plainly set forth, and suggestions were given for giving the right sort of training in that branch of the business. It was held that the selection of competent inspectors was as essential as the employment of good operators, and it was agreed that that branch of the business had been too long overlooked. Papers were read on other subjects and the meeting as a whole was considered a very successful one.

To a Macon *Telegraph* reporter, who interviewed him, Superintendent Carson said:

"The meeting was called by me for the purpose of considering certain questions bearing on the telephone service of the South. We are always on the lookout for everything tending to improve the service, and an interchange of views often brings out new and valuable ideas.

"It was not in the public nature of a convention, but was more like a chance meeting called to consider a few special subjects. I cannot say where or when we may have another such meeting. I called this one to convene in Macon because I consider it one of the coming towns and because I consider it was of a central location in our territory.

"After the papers were read and the discussions were over, the 'boys' had a sort of experience meeting of peculiar interest to members of our profession.

"Is the telephone business growing? you ask. You will think so when I say that it has increased 12 per cent. since last year, and it is still climbing ahead. We keep fully abreast of the business prosperity everywhere."

Electric Lighting Rules.

RULES AND REQUIREMENTS OF THE NEW ENGLAND INSURANCE EXCHANGE FOR ELECTRIC LIGHTING.

Mr. C. M. Goddard, electrical inspector of the New England Insurance Exchange, has sent us a copy of the following rules which have recently been adopted by the Exchange. A committee appointed by the New England Electric Exchange has approved these rules:

OUTSIDE WIRES.

1. Conducting wires carried over or attached to buildings, must be (*a*) at least seven feet above the highest point of flat roofs, and (*b*) one foot above the ridge of pitch roofs; (*c*) when in proximity to other conductors likely to divert any portion of the current, they must be protected by guard irons or wires, or a proper additional insulation, as the case may require.

2. For entering buildings, (*a*) wires with an extra heavy waterproof insulation must be used, (*b*) they must be protected by drip loops, (*c*) also protected from abrasion by awning frames, (*d*) be at least six inches apart, (*e*) the holes through which they pass in the outer wall of such building must be bushed with a non-inflammable, waterproof, insulating tube, and (*f*) should slant upward toward the inside.

3. The inspector may, at his discretion, require wires other than those used for conveying current for electric light or power, entering buildings to be protected by some approved automatic cut-out, in any locality where such wires are, in his opinion, liable to come in contact with electric light or power wires.

4. Converters, and the primary wires leading thereto, (*a*) must not be placed inside of any building (central stations excepted); (*b*) they may be attached to the walls on the outside if securely supported by substantial wooden cross-pieces or cleats.

5. Wires attached to buildings should be (*a*) free of contact with the building, and (*b*) supported by rubber hooks, glass insulators or porcelain knobs. (Porcelain knobs should not be used to support high potential wires.)

INSIDE WIRES.

(High Potential—Over 350 Volts—Arc and Series Incandescent.)

6. Wires must enter and leave the building (*a*) at the same place (*b*) through an approved cut-out switch, which must be (*c*) mounted on a non-combustible base if attached to any combustible substance, (*d*) kept free from moisture, and (*e*) easy of access to firemen and police.

7. The cut-out switch must be (*a*) double contact, (*b*) must effectually close the main circuit and cut off the interior, when turned "off" (*c*) so constructed that there shall be no arc between the points when thrown "on" or "off," (*d*) automatic in its action (not stopping between points when once started) (*e*) and indicate upon inspection whether the current be "on" or "off."

8. Wires (*a*) must be rigidly supported (*b*) on porcelain, glass or other non-combustible insulators, (*c*) free from contact with the building, (*d*) have waterproof insulation wherever there is a possible exposure to moisture, (*e*) be at least 12 inches apart, and (*f*) at least three inches from any other substance capable of acting as a conductor.

9. (*a*) When wires pass through walls, floors, partitions, etc., (*b*) or wherever protection from mechanical injury is necessary, (*c*) they must be protected by glass, hard rubber or other moisture proof, non-inflammable tubing. (*d*) (Soft rubber tubing will not be approved.)

10. (*a*) No concealed work (*b*) or wires fastened with metallic staples will be approved.

11. In perfectly dry places wires (*a*) supported by wooden cleats, which (*b*) are "filled" to prevent the absorption of moisture, and (*c*) have a backing so as to separate the wire at least one-fourth inch from the building, may be approved by the inspector.

12. A wire (*a*) having a non-inflammable insulation, and (*b*) enclosed in a moisture proof (*c*) insulating conduit or tubing (*d*) sufficiently strong to protect the wire from mechanical injury, may be used, in which case the tube may be fastened by metallic loops if desired, and the distance between wires reduced to three inches; but (*e*) the entire "conduit system" must be moisture tight—*i. e.*, joints and open ends must be sealed with some approved cement.

13. The "series" incandescent lamp must (*a*) be provided with a proper hand switch, and (*b*) an approved automatic device which will shunt the circuit around the carbon filament should it break; (*c*) it must be suspended from a hanger board by means of a rigid tube, and (*d*) must not be used in damp or wet places.

14. Any method of distributing current to incandescent lamps on high potential circuits other than as above provided for, must receive the approval of this exchange before being put into use.

15. In arc lamps indoors, (*a*) the light must be surrounded by a globe with a closed base; (*b*) the depth of the globe must be such that the point of contact between the carbons when the lamp is newly trimmed shall not be less than three inches below the upper edge of the globe; and (*c*) the globe must be enclosed by a wire netting where there is any material under the lamp that could be damaged or ignited by hot cinders, or (*d*) when the lamp is an "all-night" lamp. (*e*) Where exposed to flyings, or where any inflammable material is suspended near the lamp, spark arresters must be used.

16. Hanger boards for arc or series incandescent lamps must not be used in damp or wet places.

17. Each arc lamp must be provided (*a*) with a proper hand switch, (*b*) with an automatic switch that will shunt the current around the carbons should they fail to feed properly, and (*c*) with "stops" to prevent the carbons from falling out in case their clamps fail to hold them.

18. The entire installation must test free from grounds.

GENERAL RULES.

(Low Potential—350 Volts or less—Incandescent.)

19. For inside work, no wire smaller than No. 14 "B. & S," or No. 16 "B. W. G." will be approved.

20. Samples of wires to be used, or in actual use, must be submitted to this exchange, for tests of conductivity or of insulation, at any time when required.

21. (*a*) Wires must never be left exposed to mechanical injury, or to disturbance of any kind. (*b*) Wires must not be fastened by metallic staples. (*c*) When wires pass through walls, floors, partitions, timbers, etc., glass tubing or so-called "floor insulators," or other moisture proof, non-inflammable, insulating tubing must be used. (*d*) At all outlets to and from cut outs, switches, fixtures, etc., wires must be separated from gas pipes or parts of the building by porcelain, glass, or other non-inflammable insulating tubing (*e*), and should be left in such a way as not to be disturbed by the plasterers. (*f*) Wires of whatever insulation must not in any case be taped or otherwise fastened to gas piping. (*g*) If no gas pipes are installed at the outlets an approved substantial support must be provided for the fixtures.

22. In crossing any metal pipes, or any other conductor, (*a*) wires must be separated from the same by an air space of at least one-half inch, where possible, and (*b*) so arranged that they cannot come in contact with each other by accident. (*c*) They should go *over* water pipes where possible.

23. Twin wire must not be used except (*a*) as allowed in "conduit" wiring, (*b*) or for "pendants," fixture wiring and "portables." (*c*) An exception may be made to this rule by the inspector, where it is necessary to run a short distance, if the wire (*d*) has a non-inflammable covering, (*e*) is not concealed, and (*f*) carries but a small current.

24. The safe carrying capacity of wires when exposed to the air may be taken from the following table:

B. and S. Gauge.	Current in Amperes.
0000	300
000	245
00	215
0	190
1	160
2	135
3	115
4	100
5	90
6	80
7	67
8	60
10	40
12	30
14	22
16	15

When wires are enclosed in moulding or otherwise treated so as to prevent cooling by radiation, the carrying capacity is reduced about 40 per cent., and under such circumstances, or when the wires are installed where the temperature is unusually high, as in boiler rooms, dry rooms, and the like, wires should be fused accordingly.

25. (*a*) In rooms where inflammable gases may develop, or (*b*) where the atmosphere is very damp, the incandescent lamps should be enclosed in vapor tight globes. (*c*) Switches are not permitted in places filled with inflammable gases (breweries, distilleries, etc.), as the spark at make or break might cause an explosion. (*d*) Fusible safety plugs, if necessary in such places, must be enclosed in air-tight, non-combustible cases.

26. Soft rubber tubing will not be approved in cases where these rules require an additional covering to the insulation of the wire.

27. The entire insulation must test free from grounds.

WIRING—CLEAT WORK.

28. (*a*) Cleats made of well-filled, dry, hard wood may be used to support wires not concealed, in perfectly dry places only. (*b*) They must be so constructed as to separate wires of opposite polarity at least two and one-half inches. (*c*) Wires must be drawn taut, and cleats placed near enough together to prevent the possibility of contact between the wires.

29. Except on wooden surfaces so filled as to prevent the absorption of moisture, (*a*) the wire must have a waterproof insulation, or (*b*) the cleats must have a backing that will separate the wire at least one-fourth inch from the building.

MOULDING.

30. Mouldings must not be used (*a*) in concealed work, nor (*b*) in places where there is any probable exposure to moisture.

31. (*a*) Moulding must consist of two parts, viz., a back-piece, which shall separate the wire at least one-fourth inch from the part of the building to which it is fastened, and a cover, one of which parts shall contain the grooves, (*b*) these grooves to have between them a septum or tongue of wood so as to separate the wires at least one-half inch. (*c*) The moulding must be coated inside and out with shellac or waterproof paint, or treated in some other manner so as to prevent any absorption of moisture. (*d*) Mouldings with open grooves laid against walls or ceilings, will only be approved when such walls or ceilings are of wood, and so filled as to prevent the absorption of moisture.

CONCEALED WORK.

32. In unfinished lofts, between floor and ceilings, in partitions, and other concealed places, wires must (*a*) be kept free of contact with the building, (*b*) be supported on glass, porcelain, or other non-combustible insulators, (*c*) have at least one inch clear air space surrounding them, (*d*) be at least ten inches apart when possible, and (*e*) should be run singly on separate timbers or studding. (*f*) When thus run in perfectly dry places not liable to be exposed to moisture, a wire having simply a non-combustible insulation may be used.

33. Wires run as above (*a*) immediately under roofs, (*b*) in proximity to water-tanks or pipes, will be considered as exposed to moisture; and in such places the insulating covering of the wire must consist of a waterproof covering next the wire, protected by an external covering not easily abraded and that will not support combustion.

34. Wires must not be fished (*a*) for any great distance, and (*b*) only in places where the inspector can satisfy himself that the above rules have been complied with. (*c*) Twin wires must never be employed in this class of concealed work.

CONDUIT WIRING.

35. Wires may also be concealed by means of a system of insulating tubes, or "conduits," that are moisture proof and practically non-inflammable and have a threaded point. (*a*) A separate tube must be provided for each wire, except (*b*) in case of taps or branches carrying a current that does not exceed 15 amperes, in which case a flexible twin cable may be used; but (*c*) the two conductors of this cable must not be insulated from each other by a rubber compound. A cotton or other fibrous covering should be used, and (*d*) the joints between sections must be made moisture proof, with some cement proper for the purpose; *i. e.*, the whole system must be free from joints, cracks, etc., where it would be possible for moisture to enter the tubing.

36. These tubes may be secured by metallic loops and may be laid side by side.

37. This is the only manner in which wires may be run imbedded in plaster, cement, or any similar material. Wires run on brick walls or below timbers furred for lath and plaster, will be considered as imbedded in plaster, unless the furring strips are of such thickness as to prevent any contact between the wire and the clinches of plaster.

WIRES IN DAMP PLACES.

38. In dye-houses, paper and pulp mills, and other buildings especially liable to moisture, all wires, except those used for pendants, must (*a*) be separated at least six inches, (*b*) be thoroughly and carefully put up, and (*c*) be supported by glass or porcelain insulators, or by rubber hooks.

39. Where it is necessary to run the wires down a side wall in order to pass through a floor, the wires must (*a*) be supported from the ceiling to the floor on insulators (*b*) placed, if necessary, on a back-board, and (*c*) to protect the wires from injury, they should be boxed over from the floor to a point five or six feet above.

40. Where exposed to acid fumes, vapors of ammonia, etc., wires should (*a*) be provided with an insulation, and (*b*) supported on insulators that will not be injured thereby.

41. In places covered by Rules 38 and 40 wires may be run under rules for "conduit" wiring, and if to be concealed they must be so run, but in either case will be subject to special approval by the inspector.

FITTINGS AND APPARATUS.

SAFETY CUT-OUTS.

42. (*a*) Every portion of each installation must be equipped with safety cut-outs, that will interrupt the passage of a current in excess of the amount which that portion of the apparatus is adequate to transmit. (*b*) Fusible leads designed to carry a current of 10 amperes or over must have contact surfaces of some harder metal. (*c*) Fusible leads should be proportioned to the capacity of the wire they are to protect, and not to the number of amperes required to supply the lamps on that particular circuit. (*d*) A cut-out must be placed where the underground or

overhead service joins the inside wires, and (*e*) at every point where a change is made in the size of the wire (unless the cut-out in the larger wire is intended to protect the smaller). (*f*) A cut-out must be provided for each fixture, and (*g*) in concealed wiring, for each pendant also; but (*h*) where the wires are exposed one cut-out may be employed to protect two or more pendants, provided (*i*) the amount of current they require does not exceed seven amperes. (*j*) Stiff brackets not attached to gas pipes may be treated as pendants in this connection.

43. All cut-out devices must (*a*) be made of non-combustible material, (*b*) be placed so as to protect both sides of the circuit, and (*c*) be provided with close-fitting covers.

44. When lights are grouped, as upon electroliers, etc., the small wires to each light cannot always have cut-outs. Care should be taken, however, that the last controlling cut-out (*a*) carries as small an amount of current as practicable, and (*b*) that it will act before the smallest wire runs any risk of being unduly heated.

SWITCHES.

45. All switches must (*a*) be composed entirely of non-combustible material, and (*b*) be automatic in action.

46. All switches must be double pole, in circuits (*a*) connected to fixtures attached to gas pipes, or (*b*) carrying a current of ten amperes or over.

PENDANTS, PORTABLES, ETC.

47. (*a*) Lamps may be suspended by flexible cord pendants not less than No. 16 B. & S. or No. 18 B. W. G. (*b*) Where it enters the lamp-socket, the cord must be protected by a bushing of rubber, wood or some similar insulating material, and (*c*) the cord must be so arranged that the weight of the lamp, etc., shall not be borne by the joints or binding screws.

48. (*a*) The covering of the flexible cord, as a whole, shall be of such a nature that it will not support combustion, (*b*) in damp places the cord must have a moisture proof covering, and (*c*) the opening at the top of the socket must be closed, so as to prevent the entrance of water. (*d*) The flexible leads of portable fittings must in all cases be protected by cut-outs at their fixed points of connection.

FIXTURES.

49. (*a*) Each fixture to which wires are attached must be insulated from the piping of the building by an insulating joint. (*b*) Burrs and sharp edges must be removed before wires are drawn into a fixture. (*c*) Wires attached to or concealed within fixtures, must have an insulating covering that cannot be easily cut or abraded, and (*d*) that is moisture proof; (*e*) where attached to the outside of a gas fixture, the conductors must be so secured that their covering will not be cut or abraded by the swaying of the fixture or the movement of the bracket arm. (*f*) The difference of potential between any two wires connected with a combination or gas fixture, must not exceed 125 volts. (*g*) No wire smaller than No. 16 B. and S. or No. 18 B. W. G. must be used in fixture wiring.

ELECTRIC GAS LIGHTING.

50. Where electric gas lighting is to be used on the same fixture with the electric light (*a*) no part of the gas piping or fixture shall be in connection with the gas lighting circuit; (*b*) the wire used for the fixture must have a non-flammable insulation, or (*c*) if concealed between the pipe and shell of the fixture, must have an insulation such as is required for fixture wiring for the electric light; (*d*) the whole installation must test free of grounds, and (*e*) the two installations must test perfectly free of connection with each other. (*f*) Any such installation will then be subject to special approval by the inspector.

ARC LIGHTS ON LOW POTENTIAL CIRCUITS.

51. This system of lighting will in general be governed by the foregoing rules for low potential work, but (*a*) no wire smaller than No. 12 B. & S. must be used; (*b*) there must be a double pole cut-out at the junction of the branch with the main, and (*c*) a double pole switch in the branch. (*d*) The cut-out, switch and resistance device must be composed of non-inflammable material. (*e*) The light must be protected by a globe, etc., the same as is required for a high potential lamp.

ISOLATED PLANTS.

52. In isolated plants, (*a*) the dynamo, regulating devices, switchboards, and all wires connecting the same, must be installed in conformity with the requirements for a standard central station (see 53 to 67), and (*b*) should never be placed in any room where they will be exposed to flyings of any combustible materials.

DYNAMOS.

53. (*a*) Insulated on thoroughly dry wood, (*b*) "filled" to prevent absorption or moisture. (*c*) A waterproof cover should be provided, and kept over each dynamo when not running.

WIRES.

54. (*a*) Wires from dynamos to switchboard, and (*b*) thence to outside lines ('bus wires, feeders, primary mains, arc circuit leads and returns), (*c*) to be wholly exposed to view, (*d*) supported by glass or porcelain insulators, and (*e*) of sufficient sectional area to prevent heating. (*f*) Where passing through floors, partitions, or other woodwork, (*g*) to be protected by substantial tubes of glass or porcelain, (*h*) which shall project above and below floors, and beyond the surface of partitions, so as to insure perfect insulation. (*i*) Hard rubber tubing may be used except where passing through the floors at or near the dynamo.

55. (*a*) Where leaving the building, the wires to be looped downward, and (*b*) the tubes in which they are enclosed to be inclined so as to prevent the entrance of rain water along the wires.

56. (*a*) Wires of opposite polarity should be separated at least 12 inches, (*b*) particularly where passing through floors and partitions. (*c*) Conductors from ceiling or floor to switchboard may be run at a less distance than 12 inches from each other, (*d*) but in that case an approved insulation must be provided.

57. If (*a*) conductors from dynamos are run under floors, (*b*) except the space underneath be a perfectly dry, finished room, and (*c*) not less than six feet between floors, (*d*) they must be specially insulated, and will then be subject to approval.

58. (*a*) Each feeder and primary main to be provided with a safety fuse on a non-combustible base. (*b*) All wire connections must be soldered, if necessary, to secure good contact.

59. Branch wires for station lighting to be in accordance with the requirements of this exchange for electric light wiring.

SWITCHBOARDS.

60. (*a*) To be kept free from moisture, (*b*) located apart from woodwork, (*c*) accessible from all sides, (*d*) not enclosed and (*e*) with all electrical devices, wires and connections in plain sight. (*f*) When all wires and electrical devices are on the front, the switchboard may be set against a brick wall, (*g*) but must be detached from any woodwork. (*h*) The switchboard should be constructed either of slate or some other non combustible insulating substance, or (*i*) so-called "Skeleton."

61. (*a*) All switches and wires on the switchboard must have ample capacity and (*b*) contact to carry their possible maximum load without heating.

LIGHTNING ARRESTERS.

62. (*a*) To be located in sight of attendants, and (*b*) so placed and constructed that an arc if formed will not come in contact with woodwork or other combustible material. (*c*) Lightning arresters should be so designed as to automatically destroy any arc which may be formed by a lightning discharge or otherwise.

EQUALIZERS.

63. (*a*) Frames to be constructed of non-combustible material. (*b*) To be open and accessible from all sides, (*c*) supported at least 12 inches from all wood-work, (*d*) and located so as to be in sight of the dynamo attendants.

64. (*a*) All resistance devices to be so designed as to heat but slightly when in use, and (*b*) connected so as not to be liable, from a short circuit or other cause, to an overcharge of current; (*c*) otherwise they must be enclosed in non-combustible cases and (*d*) kept away from any wood-work.

CARE AND ATTENDANCE.

65. A competent man must be kept constantly in the dynamo room while the dynamos are running.

66. (*a*) Oil must not be allowed to accumulate on the floor, and (*b*) all oily waste must be kept in standard metal waste cans, or (*c*) removed from the station daily after the dynamos are stopped and cleaned.

67. Arc lamps must always be provided with perfect globes.

MOTORS.

68. Motors must (*a*) be placed as near as possible to the point where wires enter the building, (*b*) be mounted on filled, dry wood, (*c*) be raised at least eight inches above the surrounding floor, (*d*) be kept clean, and (*e*) covered with a waterproof cover when not in use, and (*f*) if deemed necessary by the inspector, be enclosed in an approved case.

69. Standard metal waste cans, with a self closing cover and legs raising the can at least three inches from the floor, must be provided for oily waste.

SWITCHES, REGULATORS AND CUT-OUTS.

70 (*a*) The controlling switch must be so constructed as to entirely disconnect the motor from the circuit, and (*b*) a cut-out such as is required for a similar lighting circuit, must be placed as near as possible to the point where the wires enter the building.

71. All switches, regulators, cut-outs, etc., must (*a*) be as nearly non-combustible as possible, (*b*) be protected from moisture, (*c*) have a backing of porcelain, slate cement, asbestos, or other equally non-combustible substance, and (*d*) be perfectly insulated.

WIRING.

72. (*a*) Wire having a waterproof insulation must be used. (*b*) The wire must be rigidly supported (*c*) on porcelain, glass or other non-combustible insulators, free from contact with the building, and (*d*) at least six inches apart. (*e*) No concealed work, (*f*) cleat work or (*g*) wires fastened with metallic staples will be approved.

73. (*a*) When wires pass through walls, floors, partitions, etc., or (*b*) wherever protection from mechanical injury is necessary; (*c*) they must be protected by glass, hard rubber, or other moisture proof, non-inflammable tubing. (*d*) Soft rubber tubing will not be approved.

74. These rules are not intended to preclude the running of small motors (for fans and the like) on low potential lighting circuits, the installation of which has received the approval of the inspector.

75. The entire installation must be free from grounds; but motors run on a "ground circuit" may be approved by the inspector under these rules, provided the return wire is carried to a ground outside of the building.

LIGHTING FROM GROUND RETURN POWER CIRCUITS.

76. Electric railway power stations and their car sheds may be lighted by incandescent lamps connected with their power wires if the installation of the wires meets with the approval of the inspector, but no other property may be so lighted.

MISCELLANEOUS.

77. Splices, in both arc and incandescent circuit wires, must be made so that a perfectly secure and unvarying connection fully equal to the cross section of the wire will be secured. The splice must be soldered, but solder must never be employed to complete a joint that would be loose or insecure without it. Either resin or an acid solution may be used as a flux; both are objectionable if not carefully applied.

SIGOURNEY THREE-SPINDLE DRILL.

78. Architects are urged to familiarize themselves with these rules, and to see that all contracts are made subject to the work being done in accordance therewith, and also to see that it is so done. The New England Insurance Exchange will gladly aid them to this end by giving information, advice, or inspection to as great an extent as possible.

79. A great danger in all installations is from poor contacts; consequently, avoid screw joints as much as possible; screw them up tight with good areas of contact; on no account allow them out of sight. Solder every connection as far as practicable.

80. When an electrical fire breaks out, turn off the current at the nearest switch, or sever the conductors (one at a time); then use your appliances. The injudicious use of water without these precautions may only increase the extent of the fire. In severing conductors of high electro-motive force, be careful that you stand on a good insulator, such as dry wood, and that the handle of your hatchet is dry, or personal injury may result.

DEFECTIVE APPARATUS.

81. The electric inspector of this "Exchange" shall report to its secretary such electrical apparatus as he finds is not installed in accordance with the rules of this "Exchange."

82. The secretary shall at once notify both the assured and the party installing the apparatus of all defects; and if at the expiration of 30 days from such notice he shall not have been duly notified that said defects have been remedied, the rate on both building and contents shall be advanced at least 10 cents, and the new rate duly promulgated by him.

Copies of these rules may be obtained by addressing the New England Insurance Exchange, 55 Kilby street, Boston, Mass.

TELEGRAPHIC

.... The present rate for telegraphic messages from London to Australia is about $3 a word. It is thought that it can be reduced to $1 a word. Frequent messages are sent costing £1,000, and one was sent a short time ago by a Londoner that cost $16,000.

.... Judge Hoyt, who has charge of the Western Union Telegraph Company in Clinton, Cal., has sent in his resignation to the company and expects to be relieved about Nov. 1st. The judge has tapped the key for some 42 years and has now concluded to retire from active duty.

.... The Western Union Telegraph Company has been charged with being involved with the Puritan Club, of Long Island City, L. I., and the gamblers doing business there, violating the law against pool selling. The jury has been laboring to get at facts sufficient to warrant the indictment of the company and several individuals.

.... The threatened strike of Western Union Telegraph operators in the principal Western cities did not take place as expected. The formation of local lodges of the Brotherhood of Telegraphers, it is said, led the Western Union to discharge the men most interested in the movement. In retaliation, a strike was to have been declared, but the operators, after considering the matter, decided not to strike, and several of the lodges were dissolved instead.

Sigourney Three-Spindle Drill.

A tool which will be appreciated by all electrical manufacturing companies is illustrated herewith. It is a three-spindle drill made by the Sigourney Tool Company, of Hartford, Conn.

The center spindle admits work of a diameter of 12 inches, while work 17 inches in diameter is accommodated by the outer spindles. The downward throw of the drill without readjustment of the table is 2¼ inches. The table has a vertical range of 30 inches, and shafts can be centered to the length of 38 inches. The table is also counterbalanced by a weight inside of the column, and can be turned right or left as required. On the stud of the lever pinion is a clamp stop, instantly adjustable to determine the depth of the hole to be drilled to the limit of the traverse of the spindle. On the side of the column is a planed line and on the table bracket a corresponding mark, which, when coincident, insure the exact agreement of the center of hole in table and of the spindle. The spindles are fitted to No. 1 Morse drill taper, and have three changes of speed. The spindle and its appurtenances are counterbalanced by an open coiled spring concealed in a cylindrical case above the spindle pulley. Diameter of tight and loose pulleys is six inches, and the machine is designed to run at 450 revolutions per minute.

Infringement Suit.

The Stillwell & Bierce Manufacturing Company, of Dayton, Ohio, has brought suit in the United States Court against the S. N. Brown Company, which is using a Hoppes live steam purifier. The Stillwell & Bierce Manufacturing Company claim that in using this purifier they are directly infringing the Stillwell purifier patents owned by them. This company own all the Stillwell patents for heating and purifying feed water for steam boilers, and manufacture the well known Stillwell exhaust heater and the Stillwell live steam purifier.

Electricity for a Felon.

A few days ago, says the Plainfield, N. J., *News*, a bone felon developed on the thumb of Mr. William Grannatt, Jr.'s left hand. He consulted a physician, and was told that several months would elapse before he would be able to use the hand. He suffered intense pain and could not sleep. A friend recommended Dr. Griffen. Mr. Grannatt visited the physician, and the latter operated on the diseased member with an electric battery. After the first application the pain ceased, and in four days Mr. Grannatt resumed work. The operation was entirely successful, and both the doctor and the patient feel proud of the accomplishment.

* * Ashtabula, O., is to have an electric railway to the harbor.

* * The Leavenworth, Kan., rapid transit railway has been sold to the Leavenworth Electric Railway Company for $100,000. It is the intention of the purchasers to push the electric railway project to early consummation.

* * The contract for the construction of the dam across the Kansas River, which is to furnish water and electrical power to Topeka, has been let to James Anthony and Charles B. Holmes, of Kansas City. The dam and machinery cost in round figures $1,000,000 and will give Topeka 10,000 horse-power.

* * The Shawnee Ironpoint Coal and Iron Company, at Shawnee, N. Y., was the first mining company in the State to install an electric mill plant. The electrical machinery consisted of a 40 horse-power dynamo, an eight horse-power exciter, a 15 horse-power motor and line conductors. The plant was set up in August, 1888.

* * An ordinance was passed last week by the Board of Supervisors, granting a franchise to construct an electric road from Oakland, Cal., to San Lorenzo, San Leandro and Haywards. The branch road to Alameda was not allowed, The petitioners for the franchise were Harry W. Meek, Charles E. Palmer, William J. Landers and Egbert H. Stone.

* * Sticks and stones have been placed on the Shreveport, La., electric belt line track ever since it began running, and one night last week a spike was put on one rail, and a little distance beyond a plank was placed across the track, in consequence of which a motor was thrown off and ran 20 feet before it was stopped. No one was injured, nor was the motor. The company has offered $250 reward for the apprehension of the criminal, and the citizens' council will probably offer a like amount.

* * D. T. Denny, of Seattle, Wash., is preparing to put in a new switch connecting the electric railway with the Seattle, Lake Shore and Eastern track at Edgewater. The switch will tap the Lake Shore track between Edgewater and Fremont and run east to Burke's second addition on the Edgewater front, where Mr. Denny will establish a lumber yard for the transfer of material from the Western mill. By means of the switch the Lake Shore freight cars can run over the electric railway track, which is of the same gauge as the former road. Lumber will thus be transferred from, and logs to, the mill.

* * Mr. E. N. Sanderson last week made a survey of the Lachine Rapids in company with Mr. R. D. McGibbon, Q. C., for the purpose of ascertaining the feasibility of utilizing the water power of the St. Lawrence to generate electricity to afford light and power to Montreal. Mr. Sanderson is on the staff of the Westinghouse Electric Company, and favors establishing a dam at La Tortue, on the south side of the St. Lawrence. He is also interested in the Suburban Electric Company, now applying for a charter at Quebec, for the purpose of lighting the town of Lachine and residences along the shore of Lake St. Louis.

* * The Summer Hill mines at Woodville, Pa., have just been equipped with a complete electric plant of mining machinery. The plant consists of one Westinghouse Junior engine, one 30 horse-power three wire, four pole Westinghouse alternate current generator, six Hercules coal mining machines, a 12 foot fan with a capacity of 30,000 cubic feet per minute, centrifugal pump, etc. The mining machines and the pump are operated by three horse-power Tesla motors. The entire equipment has been furnished by the Westinghouse Electric and Manufacturing Company. A careful record of the work of the mining machines in the Willock mine, which is also operated by Westinghouse electric mining appliances, shows that from July 1st until August 8th each cut represented about $1\frac{1}{10}$ tons of coal. It was found that it was impossible to keep the rooms cleaned up of the coal that was brought down fast enough to give the machines a chance to test their full capacity. Each machine is doing the work of from 12 to 14 pick miners.

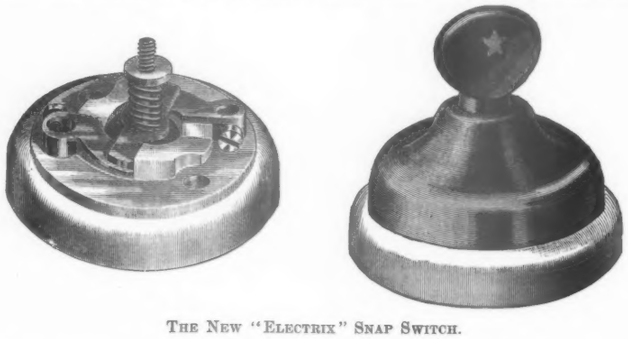
To Get English Testimony.

In the United States court at Trenton, N. J., on October 28, argument was heard by Judge Green, in the case of the Edison General Electric Company against the Westinghouse Electric and Manufacturing Company, on a motion for a commission to go to England to take testimony. The judge granted the commission.

A New Snap Switch.

We illustrate herewith the new "Electrix" five ampere snap switch, which is now being put upon the market by the Star Electrix Company, of Philadelphia, Pa.

This switch is about the smallest and neatest thing we have seen yet for five or six lights, having all the virtues and several new improvements over the larger 10 ampere switch brought out by this company. It is reported that the orders for this switch are away ahead of the company's ability to deliver, as it takes with every electric man who has seen it.



THE NEW "ELECTRIX" SNAP SWITCH.

Lynn's Great Industry.

There are to-day a little over 2,600 men and women employed in the Thomson-Houston factories, says the Lynn, Mass., *Daily Press*. Just about 100 men are hired each week. This number more than represents the increase, however, as a number are discharged weekly. These men come from all around the country, it being necessary to advertise in the Lynn, Boston and New York papers in order to get the skilled workmen required. Just at present skilled machinists are in demand. Very soon a force of heavy men will be required for the heavy work in Factory L. Ordinary-sized men would look like pigmies in the massive structure. The company is quite proud of the *morale* of the men. It is a matter of record that only four intoxicated workmen have reported for duty the past year.

One of the peculiar features of the electrical industry is the great demand it creates for new or unusual substances. Thus the demand for mica for electrical apparatus has given this mineral a value it never had before. The Thomson-Houston Company use 3,000 pounds, a ton and a half, of mica weekly. As in other industries, so in this, nothing is wasted. About 500 barrels of mica clippings are carted away weekly, ground up, and converted into insulators, those manufactured of this material being found fully as useful as porcelain or like substance.

The Lynn works of the Thomson-Houston Company now employ as many men as all its other factories, at Middletown, Fort Wayne, Cleveland and elsewhere, combined.

Atmospheric Electricity.

In a paper recently read before the Vienna Academy, Herren Elster and Geitel give the results of a year and a half's observations of atmospheric electricity on the north side of Wolfenbüttel (bordering an extensive meadow). They used a stand carrying a petroleum flame, and connected by insulated wire with an electroscope. A marked difference was found in the phenomena of spring, summer and autumn, on the one hand, and winter on the other. It appears to the authors that other factors than humidity, with which Exner seeks to explain the variations, are concerned in the case. When the temperature goes below zero, cold mist being then generally present, there is often rather a sharp rise in the values, the aqueous vapor having then less action. Rainfall in a neighboring region lowers the fall of potential both in winter and summer, and a disturbance of the normal course will announce a coming change in places still unclouded. Snow, it seems, rather raises the values. It has been shown by Linss that the course of the fall of potential is inversely as the coefficient of dispersion of the air for electricity; which, again, depends not only on the dust and aqueous vapor present, but also, according to Arrhenius' theory, on a sort of electrolytic or dissociative action of the sun's rays on the atmosphere (thus it has been shown that electricity escapes from a conductor under the influence of ultra-violet rays). The authors find their results support the latter view. They consider that the electric processes during formation of precipitates are the chief cause of the disturbance of the normal condition.

New Fire-Proof Insulation.

Mr. Edison has recently patented a method of applying fire-proof insulating covering to electric conductors. The material is prepared from gum balata or gutta-percha, or other gum of the same class, the first mentioned being preferred on account of its cheapness. A given quantity of this is dissolved in chloroform and a stream of chlorine gas passed through the solution, this action displacing the hydrogen in the material and leaving a composition which is fire-proof and, if the chlorination is stopped at the proper stage, pliable. During the passage of the chlorine, tests are made from time to time by making films of the material on glass plates and igniting such films, the proper stage being reached when the film refuses to burn. The material is then reduced to a sirupy consistency and applied to wires by passing the latter through it, and then dried in heating chambers. If the wire is covered with fibrous material it may be treated in any ordinary way to render such material non-inflammable before the application of the insulating material.

Hellos.

The telephone exchange at Walnut Hills, Cincinnati, O., has been equipped with a new switchboard.

The Hudson River Telephone Company will soon begin the work of laying its wires between Troy and Albany underground.

There is a very good reason to anticipate at a comparatively early date an increase of capital in the Bell Telephone Company to further the extension of the long distance system. The field of the company is yet small in comparison with what opportunities will offer, and stockholders will undoubtedly be offered rights to an increased capitalization.

BOOK NOTICES.

"Report of Senate Committee on General Laws as to Electricity and Electric Lighting," has been sent us by State printer James B. Lyon. The meetings of this committee in this city during the past year will be readily recalled. It is a continuous report of these meetings which forms the volume in hand. The concluding paragraph of what stands for a preface reads as follows: "In view of the fact that this is the first investigation of the kind ever made in this country, and considering the value of the testimony taken, and the numerous inquiries already made for the same from this and other States, it appears proper to ask that it be printed." We presume copies can be secured by communicating with Mr. Lyon, at Albany.

The fourth volume of the Transactions of the Kansas State Historical Society has been issued, a book of 819 pages. Half of the volume is occupied with the official correspondence pertaining to the office of Governor of Kansas Territory during the latter part of Governor Shannon's administration in 1856, and of Governor Geary's administration from September 9, 1856, to March 10, 1857, including the official executive minutes kept by Governor Geary. These documents relate to a considerable portion of the most stirring period of Kansas Territorial history. They have been gathered by Secretary Adams from Congressional documents published about that period. These documents have hitherto lain hidden from the general public, and much of what they contain will be found to be new to students of Kansas history. As a book of historical reference it is one of much value.

The Telephone Question at Albany.

On the decision of the court that it had no exclusive right to the earth for its currents, the telephone company has begun to build metallic circuits on the trunk lines running out of the city. Copper wires are used, and 25 are placed in a lead cable in order to save room. The 10 principal circuits in the city will be thus improved. These cables are carried out to the Shaker road, where the wires are again strung on poles. Manager Uline says the telephone company can't afford to give city subscribers any such expensive improvements in their telephone service. It has put in an expensive plant already, which it has spent thousands of dollars to defend as first constructed; but the courts decided against it, and subscribers must abide by the decision and get along with their lines the best they can. Long distance telephones, with all the advantages of the metallic circuit, can be had for $100 yearly.—*Albany, N. Y., Times.*

The Golden Gate Tours of the Pennsylvania Railroad.

Preparations for the inaugural series of personally-conducted tours to the Pacific Coast, under the auspices of the Pennsylvania Railroad, are progressing, and a detailed outline of their scope, routes, rates, and conditions will be published at an early day. In the meantime, sufficient headway has been made to indicate that the tours will surpass any similar pleasure trips heretofore enjoyed by the people of the Eastern States. The special trains of Pullman Vestibule, Sleeping and Dining Cars will exemplify the latest and best work of the Pullman shops. They will run through to California on quick time, delivering their passengers at desirable points in the Golden State and picking them up at the appointed rendezvous for the return trip. Tourist agents and chaperons of wide experience will conduct the party, and minister to their comfort in every possible way. Peculiarly favorable concessions will be granted them by the railroads of the Pacific Slope, so that their movements may be productive of the fullest pleasure at the lowest cost.

These tours are the most ambitious attempts yet projected by the Pennsylvania personally-escorted system to provide pleasure tours of the highest grade, and the traveling public may depend upon securing in them the most perfect service.

The first tour will leave the East late in January. It will be limited to 100 persons, and those who anticipate an early Spring outing to the shores of the Pacific should place themselves in correspondence, at once, with Mr. J. R. Wood, General Passenger Agent of the Pennsylvania Railroad, Philadelphia.

The Central Lighting Station as an Investment.

Mr. B. E. Sunny read a paper under this title at the Chicago Electric Club, October 20th. The following is a brief abstract:

Central stations, from an investor's standpoint, have not been discussed to any extent, and as I have had the opportunity of knowing the financial side of many of them, I may be able to make a few suggestions of interest.

In connection with the success and permanency of the electric light, it can be said that no one recognizes the future of electric lighting more than our friends in the gas companies, more than 300 of whom are operating electric lights in connection with their gas works. The Gas Directory says that the gas companies are operating 32,000 arc lights and 140,000 incandescent lamps. If it could be known in how many instances the individual owners of the gas property are also the owners of the electric light plant, it would be found that the number of electric lights in control of the gas companies is double the number shown.

In one year, from March, 1889, to 1890, the gas companies increased their ownership in electric lights to the extent of almost 50 per cent., indicating their faith in the most gratifying way in the earning power and permanency of the electric light.

It is a self-evident fact, that the electric light is an absolutely permanent and growing investment; that it has taken its place in the large cities side by side with the great public corporations, contributing its quota to the general service and comfort.

With the one possible exception of the telephone the future of no business has been more greatly underestimated than the electric light. The telephone people, and I was with them for several years, blundered on the growth of the business with the greatest unanimity and built everything too small. The electric light people did the same thing, and now the face of the earth is dotted with lighting properties which were poorly planned, badly built and indifferently managed. I have classed the lighting station with the water-works, the gas plant and other quasi public institutions, in the importance of the service rendered and as to financial results, but in the matter of construction I am sorry to say that the average lighting station is inferior. Where do we ever find a pumping station in other than a neat substantial brick building, rather than in a frame shell, covered with tar paper or tin? True, there are many lighting stations expensively and durably constructed, but we can all point out a long list located in cellars, basements, abandoned barns and cheap wooden structures, with the usual and customary trimmings of second-hand boilers, an engine too old for service in a saw-mill, and underwriters' wire. Of course, such a plant is a cheap one and it is within the means of almost any man to start one, but with what results? Excessive running expenses and a succession of break-downs and repair bills, until the profits are eaten up, and there is nothing left for the owners but to abandon the property or sell out to someone who will reconstruct the plant on a proper basis. This is one type of non-dividend paying lighting stations.

The remedy is old and naturally occurs to any one of moderate experience. It involves at the outset the selection of a larger lot and the construction of a larger building than we can at the time see any possible use for. There seems to be no reasonable limit to the demands that may be made for facilities, so that reasonable methods of planning do not seem applicable.

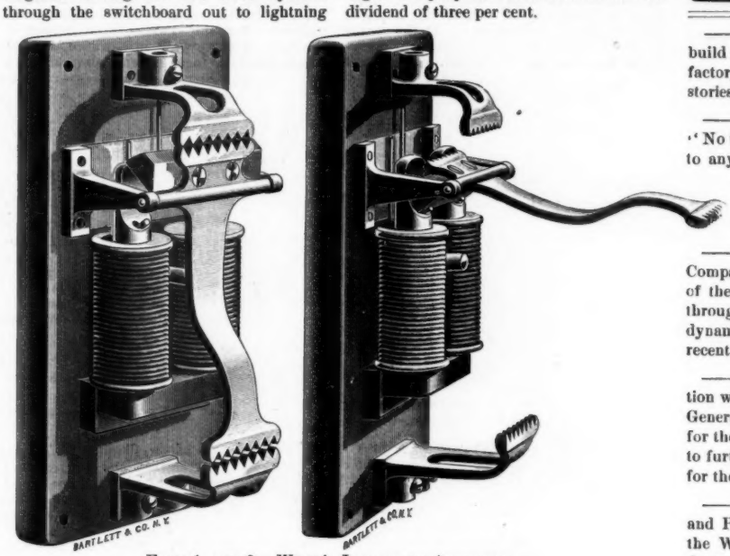
There is no fixed rule as to the dimensions of a station building that will serve the wants of its patrons, present and prospective. The growth of the business has heretofore been beyond the calculations of the most enthusiastic. The same statement is true with the telegraph and telephone.

With the increased number of people comes the increased demand for everything, and what more than light, and the electric light at that? Is it not wise, therefore, to pattern after the most substantial and permanent institutions of the time, and build, not for the present and immediate future, but for 25 or more years ahead of us? What is now standard may be obsolete 10 years hence, but, at the same time, standards are slow to change, and with the economical and efficient boilers, engines and electrical apparatus of to-day, we are safe to embark in great and important investments, and leave the almost impossible task of improving on what we now have to take care of itself.

—— The Western Isolated Lighting Department of the Thomson-Houston Electric Company, have closed contracts with the East St. Louis Packing and Provision Company, East St. Louis, Ill., for 300 incandescent lights, and Montgomery, Ward & Company, 111 Michigan avenue, Chicago, for 400 incandescent lights.

New Lightning Arrester.

Mr. James J. Wood, electrician of the Fort Wayne Electric Company, is the inventor of a new lightning arrester shown in the accompanying cuts. Fig. 1 shows the arrester in position, Fig. 2 shows it with the arc breaker thrown up, and Fig. 3 is a diagram showing the line from dynamo through the switchboard out to lightning arrester on the positive wire, thence through the lamps back to the arrester on the negative wire, to switchboard and dynamo; also the ground wire from arresters.



FIGS. 1 AND 2.—WOOD'S LIGHTNING ARRESTER.

The chief claim of this lightning arrester is that the lightning has a free passage from the line to ground, no magnets being in the line to ground circuit to offer resistance and if the current attempts to follow it will form an arc across the lower set of pointers; but in attempting to cross the upper set, a part of the current is shunted into the magnets which attract the armature which is attached to the upper part of the arc breaker thus throwing the lower end outward and breaking the arc, as shown in Fig. 2, and the arc-breaker will immediately fall back into position and be ready for another discharge.

Lightning arresters are now regarded as a very important factor in the safety of electric plants, and managers will welcome any improvement in this line.

—— The Asbury Park, N. J., Electric Light Company has declared a semi-annual dividend of three per cent.

—— The stockholders of the Edison Electric Lighting Company, of Brooklyn, have filed their consent to the mortgaging of the plant of the corporation, with all its other property, to secure a loan of $2,500,000 to be used in making improvements. The Franklin Trust Company is trustee.

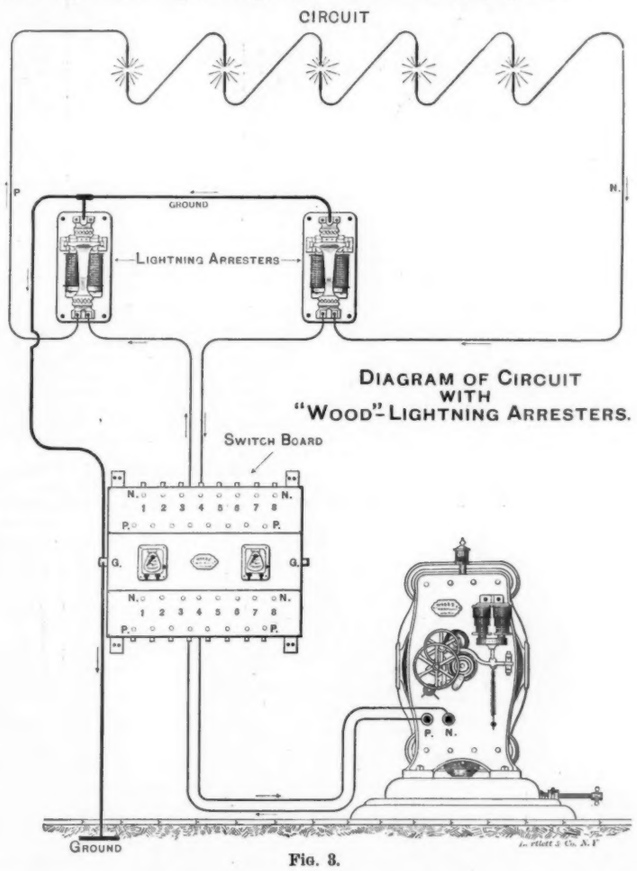


Fig. 3.

—— The Newark, N. J., Electric Light and Power Company has declared its regular quarterly dividend of 1½ per cent.

—— A trust deed from the Seattle General Electric Company to the Continental Trust Company, of New York, was filed in Seattle, Wash., last week. The deed is to certain properties in Seattle, and is for $300,000.

ELECTRIC LIGHT NEWS

—— The Schuyler Electric Company is to build an addition to its Middletown, Conn., factory, which will be 207x60 feet, and three stories high.

—— Plattsburg, Mo., wants electric lights. "No town," says the *Jeffersonian*, "amounts to anything when it loves darkness rather than light. Electric light is the requisite of a live, progressive people. Give us light or we perish."

—— The Missouri Car and Foundry Company, of St. Louis, Mo., have bought of the Thomson-Houston Electric Company, through their St. Louis agent, the arc light dynamo which was exhibited during the recent exposition.

—— Judge Goebel has overruled the motion which was filed to compel the Edison General Electric Company to provide a plant for the creation of power before it proceeded to further tear up the streets of Cincinnati for the laying of conduits.

—— The Ballston, N. Y., Electric Light and Power Company have contracted with the Westinghouse Electric Company for a dynamo of 750 light power, and will also place in their plant a 75 horse-power engine. This will double their present capacity for lighting.

—— It is said that much relief from facial neuralgia can be obtained by applying an incandescent light to the part affected. It is suggested that the lamp could also be used in poulticing advantageously. It could be laid over a flaxseed or other form of poultice, and constant heat could thus be secured.

—— The Brush Electric Light Company, of Baltimore, Md., owned by the Westinghouse Company, has received the contract from the municipal authorities of that city to light the streets and public buildings for a period of five years. The contract calls for 800 arc lights and 5,000 incandescent lamps.

—— At the annual meeting of the Edison Illuminating Company, of Milwaukee, Wis., held last week, the following officers and directors were elected: Directors; Chas. Ray, C. F. Ilsley, H. C. Payne, Frederick Layton, F. G. Bigelow, John I. Beggs and John H. Tweedy, Jr. The officers were the same as last year: President, Chas. Ray; vice-president, H. C. Payne; treasurer, C. F. Ilsley; secretary, John H. Tweedy, Jr.

—— The ladies of Randolph are determined to have street lights. Last year they raised over $100, and the town appropriated $100. A contract has been made with the electric light company for four arc lights until March 1st. The ladies are not satisfied with that, but are determined to have them longer than that, and more of them, and are talking of holding the biggest fair ever held in Randolph, holding it in the shoe factory building, if they can get it. It is an enterprise in which every citizen of Randolph will be interested, and the ladies will, of course, accomplish their object.—*Gardiner, Me., Journal.*

—— The Westinghouse Electric and Manufacturing Company received during the week preceding October 22d contracts for the installation of alternating current incandescent light plants at the following places; Manchester, N. H., 1,500 lights; Cohoes, N. Y., 750 lights; Amesbury, Mass., 500 lights; Aransas Pass, Texas, 750 lights; New Cumberland, W. Va., 750 lights; Rich Hill, Mo., 750 lights. In addition to this, the alternating current central station plant at Havana, Cuba, is again compelled to increase its capacity. The Havanese intend to furnish all the suburbs of the city with electrical illumination. They purpose to extend the plant for eight miles around the city, and to this effect the Westinghouse Electric and Manufacturing Company has been contracted with to furnish a 2,000 volt, 750 light plant.

Investigation of the Stanley Alternate Current Arc Dynamo.

BY W. B. TOBEY AND G. H. WALBRIDGE, BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, OCTOBER 21, 1890.

Before entering directly upon the subject to be presented this evening, *i. e.*, the investigation of the Stanley alternate current arc dynamo, it may be well to give a brief description of that new and extremely novel type of machine. Descriptions of it have been given in some of the electrical papers during the past Spring, but some here may not recall its general mechanical construction. The dynamo is manufactured and sold by the Westinghouse Electric Company under patents granted to Mr. William Stanley, Jr., the inventor. Mr. Albert Schmid, superintendent of the Westinghouse Electric Company's shops, deserves much credit for perfecting the machine in detail, and to him is largely due its success commercially. In general appearance it closely resembles the Westinghouse alternate current constant potential dynamo, which has become so familiar to all. In fact, the frame, pole pieces, field windings, etc., for any given size machine, are identical, whether for constant current or constant potential. The distinguishing feature between them lies wholly in the form and winding of the armatures. Figs. 12 and 13, showing diagrammatically half sections of the machine, will aid us in a description of the armature, which is built up of thin iron plates stamped in the form shown. It will be observed that a number of cores corresponding to the number of poles of the dynamo project radially from the armature, and from the sides of each core project overlapping lugs. The armature coils are not of the original "pan-cake" or oblong flat coil type placed on the periphery of the armature, but are quite thick and placed around the core projections. The overlapping lugs serve the double purpose of preventing the coils from slipping off the cores and also aid in the regulation of the machine. All the armature coils are connected in series and the terminals connected to the two collector rings, upon which bear the brushes furnishing current to the line. The field coils are also in series, so connected that the poles presented to the armature are of alternate polarity. The terminals of the field go directly to a small shunt wound exciter. Thus it is seen that the machine consists simply of an even number of field coils, corresponding to the number of poles on the machine, joined in series, and an equal number of armature coils also joined in series. That from such a simple combination of coils without any external regulation device an almost constant current is obtained for all loads, from short circuit to the maximum output of the machine, seems incredible, but such is the case.

Through the kindness of Mr. Stanley, a complete 40 light plant was sent the writers at Cornell University, at which institution we were then students. Later, the Westinghouse Company made the University a gift of the entire plant. It has been our aim to show how the regulation takes place; also, to determine the actual electrical output of the machine, and from the latter and the corresponding dynamometer readings, to calculate the efficiency of the dynamo.

The alternator was mounted on a Brackett cradle dynamometer calibrated to read in watts direct at 1,000 revolutions, the speed at which we were running.

The general method has been to obtain instantaneous values of E.M.F., arc and exciter currents at a sufficient number of points to indicate by curves the performance of the dynamo at every part of a revolution. For this purpose runs were taken with the dynamo at short circuit and with loads of 5, 10, etc., up to 40 lamps. The dynamo was run under normal conditions, viz., at a speed of 1,000 revolutions and with such excitation as to cause an output of approximately 10 amperes. For obtaining values of E.M.F. at low loads, pressure wires were run from the terminals of the dynamo and for larger loads, were taken from around 10 lamps. At all points where instantaneous values of E.M.F. were taken, corresponding values of arc and field, or exciter currents, were obtained by "fall of potential" method. Pressure wires were brought from the terminals of each of two non-inductive resistances of German silver wire placed in arc and field circuits. (See Fig. 1.) These resistances being constant, any pressure around the terminals corresponded to a certain current. The terminals of the three pairs of pressure wires were connected to the contacts of the triple-throw switch, so that by placing the switch on any pair of contacts desired, those terminals could be put in circuit with a line in which was a condenser and the revolving contact or commutator device by means of which the condenser was charged. The revolving contact used was similar to the one described in detail by Professor Ryan in his article on "Transformers," read before the Institute last December. (See *Transactions*, vol. vii, p. 1.) It consisted essentially of a knife edge of steel fastened by a wooden clamp to the collector end of the armature, and revolving with it through a circle of about eight inches diameter. The center of the knife edge was in line with the center of one of the armature coils. Upon a frame at the same end of the armature was held a wooden semi-circle, upon the periphery of which was a paper scale, divided to millimeters. At the center of the semi-circle was pivoted an arm carrying a brush holder, in which was a steel

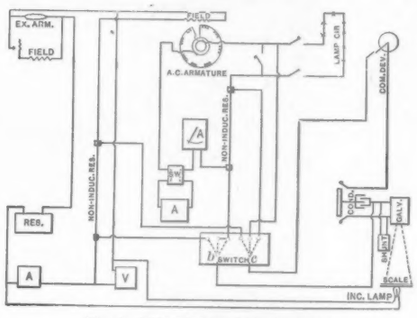


Fig. 1.—DIAGRAM OF CONNECTIONS.
A, A, A. Ammeters; V. Voltmeter.

spring. The brush holder was so adjusted that the revolving knife edge made contact with the spring several times per second. The arm carrying this spring could be clamped wherever desired, and its position designated by means of a pointer over the scale. (Much trouble experienced by other investigators in this line, due to breaking of the spring, was entirely obviated by us by putting a piece of thin rubber packing above the spring where it was clamped in the brush holder.) Thus, the condenser, placed in series, could be brought to the same difference of potential that existed between the spring and the knife edge. The arc circuit was, as shown by the diagram of connections, Fig. 1, taken from one brush directly to a Westinghouse ammeter through a switch, by means of which a Thomson balance or gravity ammeter could be put in circuit when desired. From the Westinghouse ammeter the current was taken through the non-inductive resistance to the dynamo short-circuiting switch, where the other terminal of the machine was directly connected. The exciter current was measured by a Ryan gravity ammeter, and a Hartmann and Braun type voltmeter indicated the potential around the terminals of the field. The arm of the commutating device being clamped at some desired position, the spring was adjusted so that the revolving knife edge made contact; then the switch was thrown on any one of the three pairs of terminals, for the circuits of which we wished to obtain instantaneous values. The half microfarad condenser was so connected that by closing a key it could be charged. Opening this key and closing one in circuit with the galvanometer sent the charge through the galvanometer, and the throw was noted.

The galvanometer used was of 5,000 ohms resistance, and consisted of the coil of a Sir Wm. Thomson marine galvanometer, in which was suspended a small concave mirror, having several very small magnets constituting the needle fastened on the back. The controller was a large horse shoe magnet. A simple wooden frame supported the coil. A narrow slit in a screen, behind which stood an incandescent lamp, allowed an image of part of the filament to fall on the galvanometer mirror and be reflected back to the screen, on which was a graduated scale. By placing a resistance box in shunt around the galvanometer, the throw of the needle was reduced when it was desired to read the arc E. M. F. When current readings were taken, the whole charge of the condenser was passed through the galvanometer. The galvanometer was calibrated for E. M. F. by putting the condenser and a standard potential instrument in multiple around the terminals of a storage battery giving about 120 volts. Readings were then taken of the voltage, and the corresponding throw of the needle was noted. The calibrations for currents were made by running the exciter alone and passing the current through both of the non-inductive resistances, determining its amount by an ammeter, and observing the corresponding throw of the galvanometer needle for each non-inductive resistance.

So much for a description of the dynamo, the instruments and the methods used. We now come to that which is of most interest, viz., the results obtained. In order that the curves may be more easily followed, we will give a brief general explanation of them.

The figures on the zero line, always commencing with 5, correspond to the divisions on the scale of the wooden semi-circle, a part of the commutating device. Under each plate of curves will be seen two rectangular figures representing pole pieces, which show the relative position of the curves with respect to the poles. From each curve projects a vertical arrow, always equal to one or two divisions, and its value marked near it. In all curves the direction of motion of the armature relatively to the poles is from left to right.

Fig. 2 represents the performance of the machine at short circuit. The curves, E.M.F. and current, both approach sine curves, the current rising almost in unison with the E.M.F., there being no perceptible lag. The curve of exciter current in this, as in all cases, exhibits a wavy form. Fig. 12 shows the position of the armature relatively to the poles when the E.M.F. is zero and the machine running on short circuit.

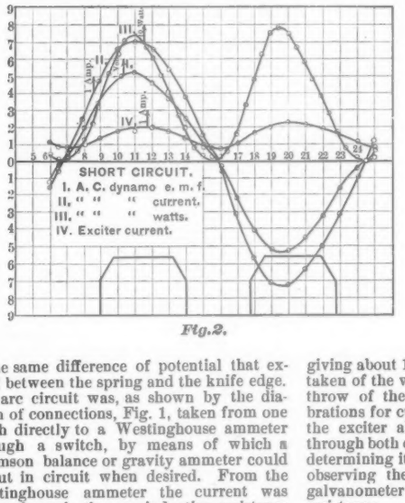


Fig. 2.

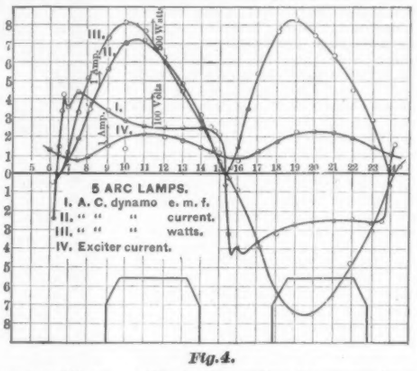


Fig. 4.

Fig. 4, representing the curves for a load of five arc lamps, shows a radical change in the E.M.F., which now approaches more nearly to the form of a rectangle than a sine curve, and immediately after passing the zeros exhibits very sharp peaks. In this case the current continues to rise after the E.M.F. has begun to fall, and also lags slightly with respect to it. A shifting of the zeros has also taken place. Comparing this E.M.F. curve with that for short circuit, it is seen that the first zero shown occurs at about 6.35 instead of 6.85. The curves for all loads of arc lamps are quite similar in form, as will be seen by referring to Figs. 5, 6, 7 and 8. As the load is increased, however, the zeros occur earlier with respect to the poles, and the current lag increases slightly. The efficiency curve, Fig. 9, tells the story of the dynamo from a commercial point of view, reaching as it does an efficiency of between 93 per cent. and 94 per cent. at full load, while at half load it is 92 per cent.

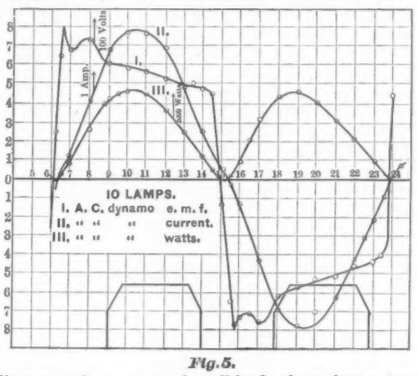


Fig. 5.

A most interesting set of curves is shown in Fig. 10, giving a comparison of the forms

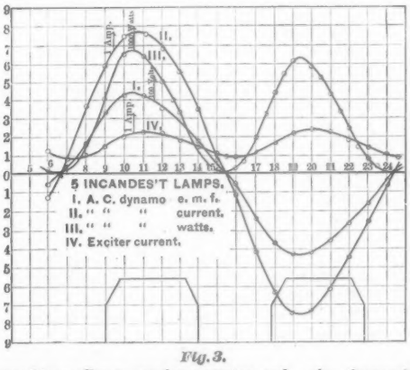


Fig. 3.

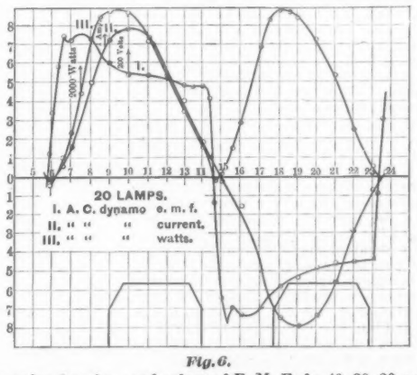


Fig. 6.

and values of E. M. F. for 40, 30, 20 and 10 lamps, their position with respect to the poles, and also the position of the zeros of E. M. F. at short circuit.

Figs. 13 and 12 show, respectively, the positions of the armature relatively to the poles for full load and short circuit.

An apparently remarkable feature of the machine is that it may be short-circuited when running at full load, without the slightest injury, and it may be run at short circuit indefinitely. That the machine regu-

lates with great rapidity is proven by the fact that upon short-circuiting it the ammeter indicates but a slight increase in current. The peculiar form of the E. M. F. curve for arc lamps led us, so far as time would permit, to an investigation of the cause, to ascertain which the following runs were taken:

First, with a non-inductive resistance of five large incandescent lamps, but no arcs in circuit; each lamp consuming about the same amount of energy as an arc lamp. Second, with nothing but an inductive resistance, consisting of a solenoid having 440 turns of No. 10 wire. The curves in both cases were similar and approached

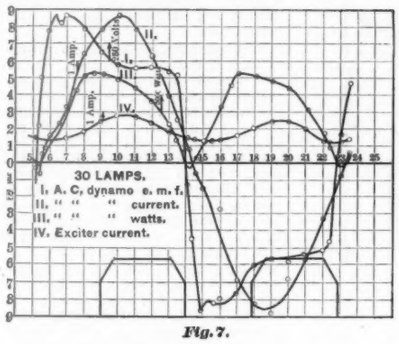


Fig. 7.

sine curves, proving the rectangular form to be due entirely to the action of the arc. Fig. 3 shows the curves obtained from the load of incandescent lamps. To more fully determine this action with no other resistance in circuit, an arrangement was made whereby an arc would be regulated by hand with the aid of a hot wire voltmeter. We took no curve for a single lamp under normal conditions with which to compare the one taken in the above manner; but the latter (see Fig. 11) has very high and abrupt elevations of E. M. F. immediately before and after passing the zeros. The theory advanced to explain the high point of E. M. F. in all the arc curves is, that when the arc breaks, the rush of cold air adding resistance to the circuit, prevents the arc forming again until the potential has risen to a point considerably higher than that required to maintain an arc once formed. To test this, we attempted to heat an arc by means of an alcohol blast, and thus prevent, in a measure, the rush of cold air. This means of heating proved inadequate, so that the results were not all that could be desired. As before stated, we had no one lamp curve with which to compare it, but as compared with the one lamp regulated by hand, the sharp corners of E. M. F. were much modified. It is not certain, however, whether this was due to the action of the lamp regulating coils or to the action of the flame. The current curve in all cases approaches a sine curve in form, but is always slightly steeper on the left or front side; direction of rotation being from left to right. Although the current lag is practically nothing at short circuit, or for any load except arc lamps, it increases slowly as arc lamps are added. For 40 lamps it is about 4½ per cent. of the time of an alternation. The wavy form of the exciter current is probably caused by the variable resistance of the magnetic circuit, due to the projecting cores and lugs of the armature as they approach and recede from the poles. The values of E. M. F. and current were found by taking the square root of the mean square of 36 ordinates of a curve, representing a complete cycle. Although the current lag was very small, the product of the values of current and E. M. F. obtained as above did not give the watts. The watts were obtained by plotting a curve, the points of which were the products of the instantaneous values of E. M. F. and current; then integrating by a planometer. Dividing the value of the watts thus obtained by the current, we obtained a value of the E. M. F. which was usually about seven volts lower per lamp than the corresponding value obtained from the square root of the mean square. This difference was no doubt due to the extremely high values of the E. M. F. when the current was very low, as the negative work was negligible. To distinguish between the two values we have called the one obtained from the square root of the mean square, the "actual" E. M. F. while the one obtained by the second method has been called the "effective" E. M. F., it alone being effective in doing work on the circuit.

It is very much of a question in our minds as to whether the square root of the mean square, obtained from the rectangular E.M.F. curves for arc lamps, gives the actual E.M.F., but for the lack of a better term the values thus obtained have been called the "actual" E.M.F.'s.

For arc current values we have assumed the square root of the mean square to be correct, and if not actually the case, they are very close approximations, as the current curves are practically sine curves.

The exact values of E.M.F. or current are of little consequence, however, except as a matter of interest, since the electrical output in watts is known, this alone being required to determine the efficiency.

In conclusion we can simply state what our investigations have shown, that the dynamo, aside from being very efficient and of most excellent regulation, is, as stated at the beginning, an extremely novel and interesting type of machine.

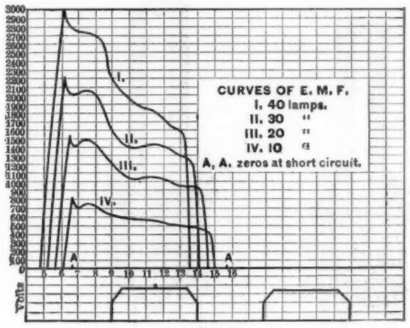


Fig. 10.

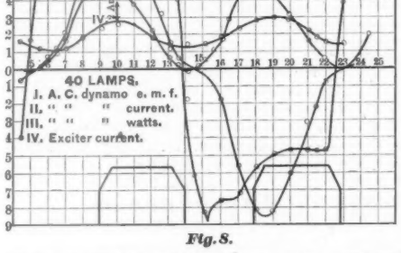


Fig. 8.

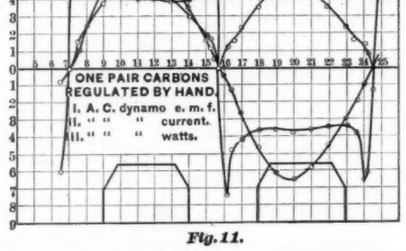


Fig. 11.

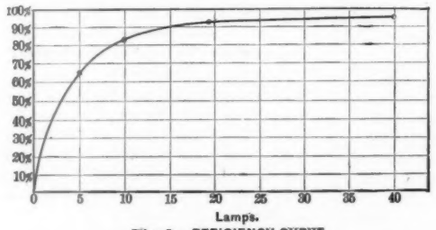


Fig. 9.—EFFICIENCY CURVE.

TABLE OF DATA.

	√Mean sq. of E.M.F.	Volts per lamp, "actual."	√Mean sq. of current.	Volts per lamp, "effective."	Mean watts electrical.	Watts excitation.	Mean watts by dynamometer.	Efficiency.
Short Circuit	3.53	.....	9.78	.....	35	155	1780	
5 Incandescent	289	57.8	10.32	59.3	3060	158	3900	75.3%
5 Arc	285	57	9.98	30	2500	165	3584	66.6%
10 Arc	.....	.....	10.7	55.3	5700	190	6630	88.5%
20 Arc	1100	55	10.36	48.3	10000	190	10680	92.3%
30 Arc	.....	.....	.....	.....	304	304	12120	
40 Arc	.....	.....	9.82	41	16000	340	16950	93.2%
1 pr. Carbon	42	42	8.86	35.5	314			

A New Application of Electricity.

A most successful method of lighting has, according to the *Cabinet Maker*, been adopted in those rooms of the Technical College, Finsbury, England, which are used by the evening classes, and it is of the greatest interest to all who study color at night. Every one knows the difficulty of working in color in the evening, and especially is it trying to beginners. Yellow appears to be white, purple appears black, and other colors change in a similar manner, and the student who innocently uses those pigments in the gas light is sometimes appalled at his work when it is submitted to the light of day. To obviate these difficulties, the electric light has been introduced into the rooms with every success. As this is, we believe, the first experiment of its kind in this country, a description of the methods adopted and the results obtained may be both interesting and instructive. The painting rooms are lit by a number of incandescent lamps, of 16 candle-power, and each lamp is so shaded by adjustable reflectors that the light can be turned any way and thrown in any direction, and can be used by one or three students at a time. The lamp can be raised or lowered, as best suits the work in operation. The special light in the life room is an incandescent lamp of 100 candle-power, and is so arranged that a direct light is thrown upon the model. Although the result does not quite equal the rich diffused light of day, it is sufficiently successful to be very gratifying, and greatly increases the comfort and opportunities of the student. A no less satisfactory effect is obtained in the modeling room by means of an arc lamp of about 1,000 candle-power. This lamp is so disposed that no direct light from it reaches the model or the student's work. A reflector beneath the lamp throws the light upwards, and it is then reflected from the white ceilings and walls. It thus becomet so thoroughly diffused that while the model is well seen, no deep shadows hide the detail. At the same time, a pleasant soft light is thrown upon the clay at which the studens is working. There is not only the superiority of the light in its whiteness, brilliancy and adaptability to moving about, but in appearance it possesses a charm of its own.

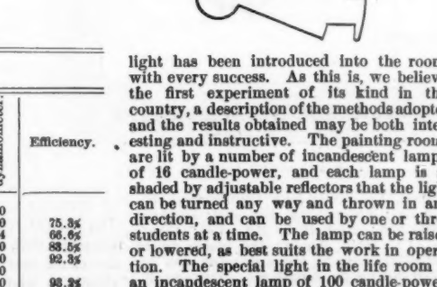


Fig. 12.

Electrocution News.

The first motion to secure final action from the Supreme Court of the United States on the question of the constitutionality of the New York Electrical Execution Law, was made in the Supreme Court, at Washington, October 27. It was moved that the case be advanced and set down for a speedy hearing. The point raised in the case is that the Kemmler execution demonstrated that killing by electricity is a cruel and unusual punishment, and, as such, prohibited by the Constitution of the United States.

The case in which the motion to advance was made is that of the Japanese, Shiboya Jugigo, against A. A. Brush, agent and warden of the New York State prison. Counsel, both for the State and for the prisoner, concur in the motion to advance. There have been several stays of execution already in Jugigo's case, and another will undoubtedly be necessary, as the case can hardly be decided before the time last fixed for his death. Chief Justice Fuller took the papers in the case.

Judge Fish last month sentenced Wood, the murderer of Leander Pasco, to be executed in the State prison at Dannemora during the week commencing November 3. Judge Whitman, counsel for the prisoner, served notice of appeal. This should have acted as a stay of sentence, but the Warren County authorities seem to have disregarded the notice of appeal, for Wood was taken to the prison at Dannemora. Judge Whitman began an investigation, and learned that no notice of the appeal had been taken. Then

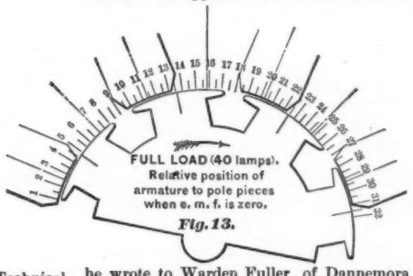


Fig. 13.

he wrote to Warden Fuller, of Dannemora prison, advising him of what had been done. Judge Whitman has received this in reply:

CLERK'S OFFICE, CLINTON PRISON,
DANNEMORA, N. Y., October 25, 1890.

Hon. J. M. WHITMAN.

DEAR SIR: In answer to yours of the 22d inst., I would say that we are making all preparations to execute Joseph Wood, convicted in Warren County of murder in the first degree, the week commencing November 3, 1890, according to the order now on file in this office, and shall do so unless duly served with notice of appeal or other legal proceedings prevent. I am yours very truly,

ISAIAH FULLER,
Agent and Warden.

Judge Whitman at once began to prepare the necessary papers, and will go to Clinton County, where he will make an application to Judge Weed for a writ of *habeas corpus* requiring Warden Fuller to produce the body of Wood on the ground that he is illegally detained in Clinton prison. Members of the bar have advised Judge Whitman to prefer charges to the Governor against the County Clerk and District Attorney of Warren County, on whom the notice of appeal was served in open court immediately after sentence was passed on Wood.

Light Troubles in Montreal.

Mr. Justice Davidson heard the argument in the case of Fuller *vs.* the City of Montreal on October 15th. In this action Mr. Fuller asks that the resolution of the council, passed in 1888, extending and adding to the contract of the Royal Electric Company, should be set aside as illegal and beyond the powers of the corporation. Among other grounds urged were that tenders ought to have been asked for, but offers were sent in, and, although lower than the successful company, were not accepted. It was also urged that the City Council could not bind itself longer than a year, seeing its want of power to appropriate for expenses beyond certain limits, and the possibility of knowing what these limits would be beyond the current year.

KINDRED INTERESTS

The E. S. Greeley & Company, 5 and 7 Dey street, New York, are enjoying an especially heavy Fall trade.

The Goulds Manufacturing Company, Seneca Falls, N. Y., are now fitting their triplex electric pumps with raw hide gears on the pump counter and motor armature shaft.

The Goodyear Hard Rubber Company, 9 to 13 Mercer street, make a specialty of high class hard rubber goods. They are just now doing a large business in storage battery cells.

J. C. Walsh Gasoline Torch Manufacturing Company, 48 West Adams street, Chicago, are now making large shipments of their torches to foreign consumers. Recent orders have come from England and France.

Robin & Sadler, of Montreal, have just completed for the Manitoba Electric and Gas Light Company the largest and heaviest belt ever made in Canada. It is 85 feet long, 40 inches wide, and is made of three-ply leather.

The Fletcher & Fletcher Electric Company, Cleveland, Ohio, are advertising their specialties *a la mode*. Like Silas Weg they have "dropped into poetry," the latest effusion being a pretty parody on the old nursery jingle, "Twinkle, twinkle, little star."

J. Elliott Shaw & Company, Philadelphia, owing to the increased demand for their Norway iron frame bells and other electrical supplies, have recently removed from 632 Arch street to 43 North Seventh street, where they will have better facilities for supplying the wants of their many customers.

The Complete Electric Construction Company, 24 Cortlandt street, New York, have just secured the contract for equipping the O'Day & Rockefeller building at Buffalo, N. Y., with 1,000 lights. The building is eight stories high and covers a block. Current will be furnished by the local electric light company.

The Buckeye Engine Company, Salem, Ohio, have recently added to their already immense plant a building 55x100 feet, three stories high, and another addition to their furnishing room 55x60 feet, two stories high. Their customers will now be accommodated more promptly, as for the past six or eight months the company has been crowded with orders in excess of their capacity.

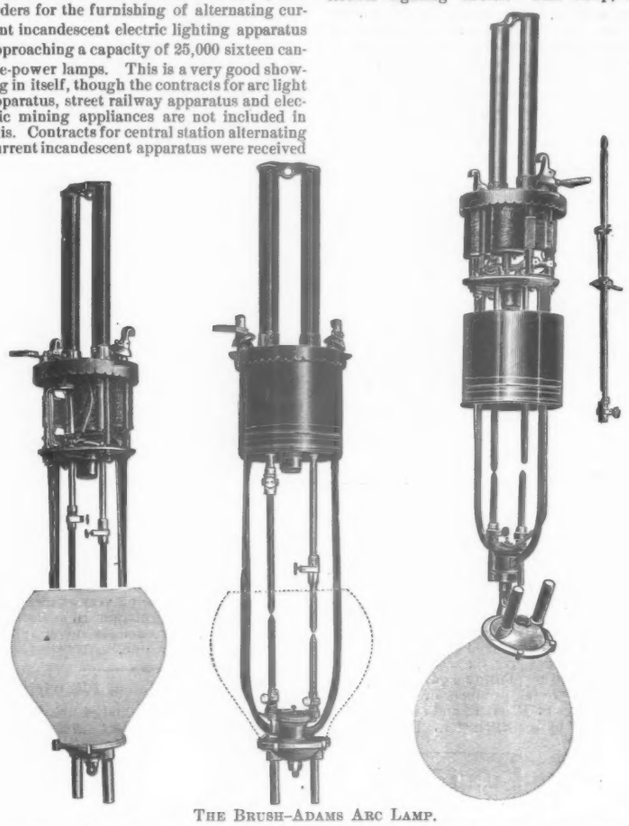
The Central Electric Company are showing a piece of plain Okonite wire that was placed in the Lumber Exchange Building at Minneapolis five years ago, and has been used continuously ever since. The wire was stapled to the fire-proofing and plastered over, and is now apparently in as good condition as ever. Okonite seems to become more popular with architects and electric light men each year, and has so far withstood the severest tests that have been applied to it. The Central people have a stock of fully 2,000,000 feet in their warerooms.

Alexander, Barney & Chapin, 20 Cortlandt street, this city, have taken orders for large quanties of Edison lamps, as well as the "A. B. C." lamp, during the past week. The "A. B. C." lamp, having been formally introduced to the electrical fraternity, is now seen in public places "shedding its effulgent rays, etc." The lamp certainly gives an excellent light, and its users will be likely to get the value of their money. The new prices of Edison lamps have also caused an increased boom in this brand. It would seem to be a good opportunity for consumers to lay in a season's supply of incandescent lamps.

The Westinghouse Electric and Manufacturing Company has concluded a very excellent record of contracts for the month of October. During the first three weeks of that month, the company had orders for the furnishing of alternating current incandescent electric lighting apparatus approaching a capacity of 25,000 sixteen candle-power lamps. This is a very good showing in itself, though the contracts for arc light apparatus, street railway apparatus and electric mining appliances are not included in this. Contracts for central station alternating current incandescent apparatus were received from the following places: Evanston, Ill., 750 lights; Baltimore, Md., 6,000; Elmira, N.Y., 1,500; Oswego, N.Y., 750; Durango, Col., 750; Lincoln, Neb,, 1,500; Orange, N. J., 750; Uxbridge, Mass., 750; Tampa, Fla., 750; Cohoes, N. Y., 750; Manchester, N. H., 1,500; Amesbury, Mass., 500; Aransas Pass, Tex., 750; New Cumberland, W. Va., 750; Mason City, Ill., 500; Havana, Cuba, 750; Rich Holl, Mo., 750; Clearfield, Pa., 500. Among the places where alternating current arc apparatus was installed during the month are: Oswego, N. Y., 60 lights; Clearfield, Pa., 25 lights; Washington. Pa., 60; Norwich, N. Y., 25; Baltimore, Md., 250.

The Brush-Adams Arc Lamp.

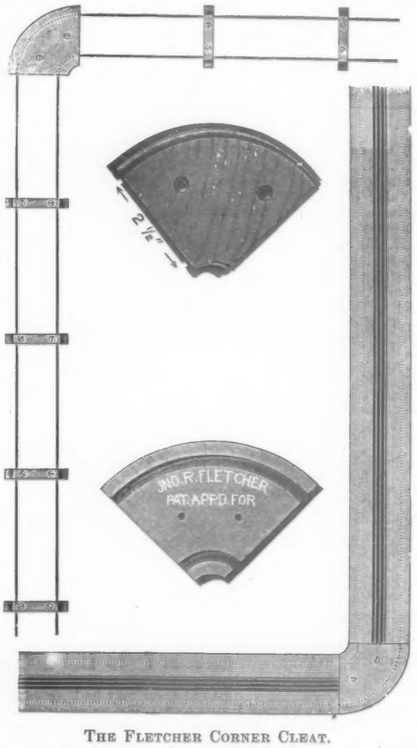
The new Brush-Adams arc lamp just announced by the Brush Electric Company, of Cleveland, Ohio, is attracting interest in electric lighting circles. This lamp, the manufacturers state, has been designed from a user's standpoint, and the arc lighting companies will find it extremely valuable. All springs that can in any way influence the arc have been abolished, and thus the chief cause of uneven and changing adjustments is eliminated. No glycerine, oil or mercury is used. The frame of the lamp is entirely and durably insulated from the working parts. Unless a hanger board is desired, no hood need be used, as the lamp is weather-proof. Hanger boards, globes, jackets, rod protectors, etc., are all alike for single and double lamps, and a large saving is thus made to lighting companies in the stock of spare parts required to be kept on hand.



THE BRUSH-ADAMS ARC LAMP.

The method of securing the globe upon the lamp is said to effectually prevent the blowing off of globes or breakage from heating or drops of melted copper from the carbons. No thumb-screws, which so often crack the globes, or drop out and loosen them, are used, and it is claimed that the flaming arcs which sometimes occur when the lamps are about to cut out cannot possibly cause breakage of globes. An excellence that will be quickly appreciated, especially in "hot trimming," is seen in the ease and rapidity with which the globe can be removed and placed out of the way.

The Brush-Adams lamp is adjusted to a standard current and voltage and no means of changing this adjustment is provided. The current required is stamped upon the lamp and with this current the manufacturers claim that it will burn with perfect steadiness and reliability on any circuit throughout the country. Lighting companies and the public suffer much from re-



THE FLETCHER CORNER CLEAT.

adjustments made by careless, incompetent or tinkering employés. The adjustments of the new Brush lamp need never be changed, or if required to be altered for a different current, must be changed with special but inexpensive tools provided by the manufacturers. Cleanliness of arc lamps is necessary for perfect working, but is often neglected in dusty or smoky locations on account of the difficulty of cleaning, involving in the old forms the taking down and apart of the lamp. The Brush-Adams lamp is so constructed that while the lamp is in its ordinary burning position in the street or elsewhere, the rods, clutches, and other parts requiring cleaning, can be slipped out quickly and put back without any soldering or other work.

Another valuable feature is the arrangement of carbon rods and clutches. The clutches are claimed to be as durable as any other part of the lamp, and the rods do not require to have the true round surface usually necessary, as the bearing surface of the self-cleaning clutches will feed a rod pitted or scarred or torn. The cut-out is positive and sure, with no liability to burn out, and a very effectual device is provided for preventing the "lapping" of carbons and for insuring the lighting of the lamps whether trimmed with the carbons apart or in contact. The jacket, though tight, can be easily removed. The exterior finish of the standard lamp is black japan with bronze trimmings, the idea being that the user can bronze or ornament this surface for special purposes, if necessary. The bright brass lacquered finish of many lamps, while showy when new, is difficult and expensive to renew. The hanger boards, alike for single or double, indoor or outdoor lamps, are provided with a switch, very strongly made, arranged to close one circuit before the other is opened, to prevent arcing, and to cut the lamp entirely out of circuit when switched off.

The Brush Electric Company, the earliest manufacturer of modern arc lamps and lighting systems, and recently so successful in its patent litigations, claims that this lamp is a decided advance in the art, and intimates that other important announcements in different styles of apparatus will soon follow.

Fletcher's Corner Cleat.

We illustrate on this page a device designed to save the time and labor involved in fitting corner mouldings by mitre. A saving in cleats and screws or nails is also effected by the use of the Fletcher corner cleat. A building where these cleats are used presents a much handsomer appearance than when wired in the ordinary way. The device speaks for itself. The Empire City Electric Company, No. 15 Dey street, New York, handle this specialty.

Mules vs. Electricity.

The races between the mule cars and those driven by electricity on their way out to the Fair Grounds are always amusing and often rather exciting, says the Dallas, Tex., *News*. A *News* man was on one drawn by a pair of the asinine species, when such a race came up. No contest between two of the great Mississippi steamboats in the olden time, with bacon and cotton for fuel and a nigger on the safety valve, could have aroused more interest. The passengers stood on the steps, waved hats and handkerchiefs, and cheered wildly as their respective cars from time to time would forge ahead.

American Society of Mechanical Engineers.

The twenty-second meeting of the society will be held at Richmond, Va., from Nov. 11th to 14th. Good railroad facilities and hotel accommodations have been provided for those desiring to attend the meeting. Among the topical questions to be discussed are these:

"What limits are there to the speeds of a hot-air or caloric engine? What is the least and the greatest number of revolutions per minute, about which you know, in such engines?

"Have you had any experience in outdoor work at night, in wind and storm, with portable apparatus for light in large quantities, other than electric light?

"What is the best design for line shafting, transmitting over 50 horse-power, permitting them to be stopped and started on any floor, without interfering with the motor or other shafting?

"What is the best form of cylinder lubricator for engines carrying 140 lbs. of steam pressure or over?

"What are the maximum safe speeds for hoisting and reversing in an overhead traveling crane, in a machine-shop?"

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON OCTOBER 28, 1890.

439,102 Electric motor; Chas. S. Bradley, Yonkers, N. Y.

439,151 Dry battery; Wilhelm L. F. Heilesen, Copenhagen, Denmark.

439,164 Perforator for automatic telegraphing; Frank D. Mack, Chicago, Ill.

439,178 Method of repairing incandescent electric lamps; Casimir Panthonier, Paris, France, assignor to the Society L'Incandescence Electrique, same place.

439,180 Electric elevator; Francis B. Perkins, Boston, Mass.

439,182 Trolley pole; Louis Pfingst, Boston, Mass.

439,192 Trolley pole for electric cars; Benton C. Rowell and Francis E. Galloupe, Boston, Mass.

439,213 Electro-magnetic clutch; Curtis H. Veeder, Lynn, Mass., assignor to the Thomson-Houston Electric Co., of Connecticut.

439,237 Apparatus for transferring electric car batteries; Frederick G. Corning, New York, N. Y.

439,238 Electro-dental heater; Luther A. Faught, Philadelphia, Pa., assignor to the Wilmington Dental Mfg. Co., same place.

439,240 Method of and apparatus for preparing electrodes for secondary batteries; Chas. D. P. Gibson, Jersey City, N. J.

439,262 Electric railway; Lawrence Westerland, Atlanta, Ga., Mary C. G. Westerland, Administratrix of said Lawrence Westerland, deceased.

439,295 Recording signaling system; William J. Fraser, Milwaukee, Wis.

439,301 Secondary electric battery; Jacob F. Mehren, Chicago, Ill.

439,304 Electric lamp socket; John O. Phillips, New York, N. Y.

439,308 Automatic wire finder for trolley heads; Geo. S. Slocum, Newport, R. I.

439,324 Secondary battery; Edward J. Mason, Waterford, Canada, assignor of three-fourths to Frank Brown Allan, Elias Edw. Slaght and John William Thompson, all of same place.

439,345 Electric locomotive; Francis W. Dean, Cambridge, Mass.

439,347 Electric bell; John F. Fields, St. Ignace, Mich.

439,363 Electric lamp. 439,364, 439,365 Incandescent lamp socket. 439,366 Incandescent electric lamp. 439,367 Incandescent electric lamp socket; Alfred Swan, Orange, N. J., assignor, by direct and mesne assignments, to the Insulite Mfg. Co., New York, N. Y.

439,381 Electric meter; William H. Bristol, Hoboken, N. J.

439,389, 439,392 Electric lighting system. 439,390 System of electric lighting. 439,391 Junction box for electric wires. 439,393 Carbonizing chamber; Thos. A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Co., New York, N. Y.

439,398 Thermal cut-out; Calvin Goddard, New York, N. Y., assignor to the Edison Electric Light Co., same place.

439,409 Railway track electrical annunciator; Jacob W. Lattig, Easton, Pa., assignor to the National Switch and Signal Co., same place.

439,416 Method of making storage battery plates; William Morrison and Louis Schmidt, Des Moines, Iowa, assignors to the Hess Electric Storage Battery Co., same place.

439,417 Automatic regulator for electric currents; William Morrison, Des Moines, Iowa, assignor to the Hess Electric Storage Battery Co., same place.

439,428 Electric railway; Chas. Richter, Camden, N. J., assignor to the Electric Construction Co., of New Jersey.

439,459 Synchronous alternating current electric motor; Chas. Zipernowsky, Maximilian Deri and Otto T. Blathy, Buda-Pesth, Austria-Hungary.

439,475 Mechanical telephone; Hemburn M. Chamblin, Newton, Ill.

439,516 Porous cup for galvanic batteries; Chas. A. Hussey, New York, N. Y., assignor to the Crosby Electric Co., same place.

439,577 Electric motion transmitter; Mark W. Dewey, Syracuse, N. Y., assignor to Dewey Corporation, same place.

439,584 Electric railway motor car; Edmund Wagemann, Little Rock, Ark., assignor of six-sevenths to John D. Adams, Dean Adams, Oscar Davis, John W. Davis, Horace G. Allis and John B. Jones, of same place.

439,594 Secondary battery; William B. Hollingshead, Bronxville, N. Y., assignor of one-half to Sydney H. Carney, New York, N. Y.

439,597 Conduit for electric railways; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Co., of Connecticut.

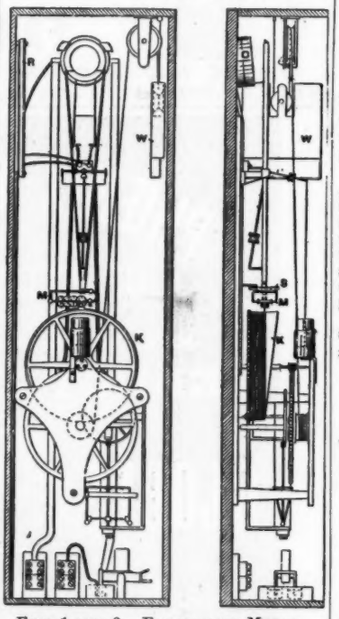
439,602 Electric switch; Jno. A. K. McGregor, New York, N. Y., assignor to himself, Herman Cohn, Edward Cohn, Henry Wallach and Solomon J. Wallach, trustees, all of same place.

That Cincinnati Telephone Case.

The hearing of argument in the Cincinnati "telephone case" was begun in General Term of the Superior Court, on October 27, and is now being heard. The case comes up on error from the decision of Judge Taft, ordering the Mount Auburn Inclined Plane Railway Company to change its system of propelling its street cars by electricity from the single trolley (now in use) to a system which will not interfere with the use of telephones along this line of road. It was this argument which the late A. D. Bullock, the principal owner of the telephone lines, came on from the East to attend, reaching Cincinnati but a few days before his sudden death. Having lost their case below, the burden in the error proceeding is upon the railroad company. Ex-Governor John S. Wise, of Virginia, representing this company, opened the argument and occupied the entire first session of the court.

Sir William Thomson's Electricity Meter.

This instrument comprises a current indicator and a quantity meter, whereby the amount of electricity which has passed during any given time is recorded by a train. The indicator consists of a light aluminium frame, free to turn about a horizontal axis, having at its top end a coil of fine copper wire C (Fig. 1), and at its lower extremity a train of counting wheels M. The frame is supported on knife edges, and electricity is conducted into and out of the fine wire coil by two spirals of fine copper wire H. The resistance of this coil is about 30 ohms, and it is joined in series with an anti-inductive platinoid resistance, R, of 970 ohms. When the meter is in action, a small current is kept passing through this circuit. The whole current to be measured is conducted through a fixed coil C of copper ribbon, which is



FIGS. 1 AND 2.—ELECTRICITY METER.

placed with its plane parallel to the plane of the fine wire coil when the latter is in its zero position. A scale S (Fig 2), divided to give readings in amperes, is attached to the indicator. The recording apparatus consists of the train of counting wheels mentioned above, and a revolving cam K, driven by clock-work, which is kept in motion by a weight W. The cam revolves uniformly, and when there is a current at each revolution comes in contact with a trailing wheel attached to the counting train, which it turns, making a record.

The action of the meter may be shortly explained as follows: When no electricity is passing, the indicator stands at 0 on the scale S, in which position the trailing wheel on the counting train is quite clear of the cam, so that no record is made. When electricity is passing through the fixed coil, the top end of the indicator is repelled *outwards*, and the counting train of wheels is brought *inwards* towards the cam, to a position depending upon the current, which can be read off on the scale. In this position the trailing wheel is brought into contact with the surface of the cam, and is turned round proportionately to the current. The current indicator is made adjustable, and can be altered by an inspector or an official of the supply company. As at present arranged the meter has to be wound up periodically. It is intended that this should be done by the consumer, and an arrangement is made by which the current is automatically cut off from the house when the weight is run down. Precautions are also taken to prevent any fraudulent tampering with the instrument. We are indebted to our London contemporary, *Industries*, for the accompanying illustrations and facts.

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Saturday, November 1, 1890. New York, Boston and Washington Stock Exchanges.

NEW YORK.	
Western Union Telegraph Co.	84¾
American Telegraph & Cable	83.
Central and South American	155.
Mexican	206.
Commercial Cable Co.	162.
Postal Telegraph Cable	39.
Edison General Electric Co.	90.
" " " Deferred	86.
Consolidated Electric Light	
Edison Electric Illuminating Co.	68.
United States Electric Light	30.
North American Phonograph	35.
BOSTON.	
Thomson-Houston Electric Co.	51.
" " " Preferred	97¼
" " " Series C	11½
" " " Series D	6⅝
" " International Co.	
" Welding Co.	185.
" European Welding Co.	60.
Ft. Wayne Electric Co	12⅝.
TELEPHONE:	
American Bell	225.
Erie	50.
New England	52.
Mexican	.75
Tropical American	
MISCELLANEOUS:	
Edison Phonograph Doll	2.
WASHINGTON.	
Pennsylvania Telephone	26.
Chesapeake and Potomac	20.
American Graphophone	14⅛.
United States Electric Light (Washington)	150.
Eckington and Soldiers' Home Electric Ry.	64.
Georgetown and Tennallytown	50.
PITTSBURGH.	
Westinghouse Electric Mfg. Co.	29.

Schiller and the Lightning.

A curious incident is handed down from the boyish life of Schiller, says the Boston *Herald*. One day, in a tremendous thunder storm, the family gathered together in ill-disguised terror. But Fritz was missing, and the father, alarmed for his safety, sought him in vain in all the rooms of the house.

He went outdoors to search for the truant, and, to his surprise, found him perched on a branch of a solitary tree, eagerly watching the heavens and the flashes which lighted up the gloom. He was wholly indifferent to the rain, which had wet him to the skin, and to the danger he incurred. To the sharp reproof of the father the boy replied with a glowing face:

"The lightning is so beautiful I wished to see where it comes from."

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Buttons, 7c.; 50c. Switches, 15c.
40c. Bell Hangers' Staples, per lb., 10c.
$1 Leclanche Batteries, 45c.
$1 Carbon Batteries, 40c.
$3.75 Spark Coils, $1.50; $10 Medical Batteries, $3.50.
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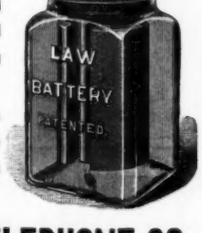

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Yours, very truly,
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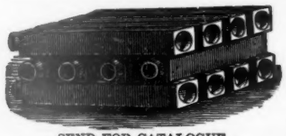
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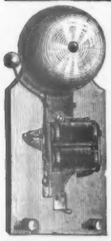
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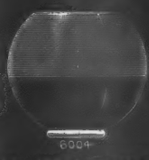
GLOBES  **SHADES**
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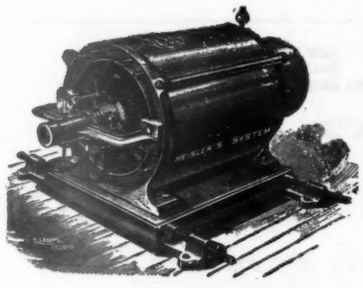

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C	8	.....	.....	.....	6.5	1½	5,000 FEET PER MINUTE.	530
C	.....	10	.....	.....	6.3	1½		530
C	.....	.....	.....	25	8.0	2		530
E	16	.....	.....	.....	12.0	2½		780
E	.....	20	.....	.....	12.5	2½		780
E	.....	.....	26	.....	13.0	2⅝		780
E	20	.....	.....	.....	15.0	3		990
E	.....	25	.....	.....	15.6	3		990
E	.....	.....	32	.....	15.0	3		990
E	.....	.....	.....	50	16.0	3		990
E	28	.....	.....	.....	21.0	4½		1,360

Ball Electric Light Co.
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G	.....	35	.....	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
G	.....	.....	45	.....	21.0	4		1,360
G	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
H	.....	50	.....	.....	30.0	6		1,750
I	.....	.....	64	.....	29.5	6		1,750
I	52	.....	.....	.....	38.0	8		2,290
I	.....	65	.....	.....	38.6	8		2,290
I	.....	.....	83	.....	38.0	8		2,290
J	64	.....	.....	.....	46.5	10		2,770
K	.....	80	.....	.....	47.1	10		2,770
K	75	.....	.....	.....	52.5	12		3,300

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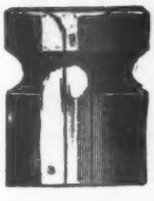

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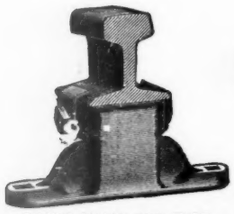

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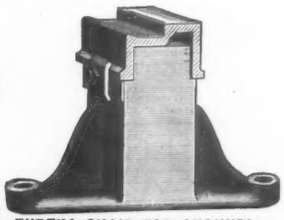

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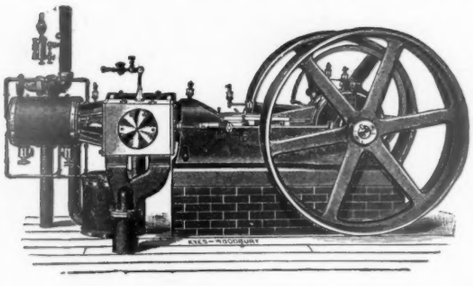

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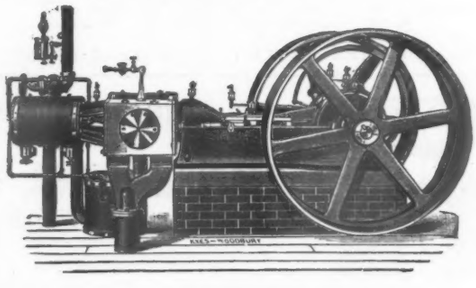

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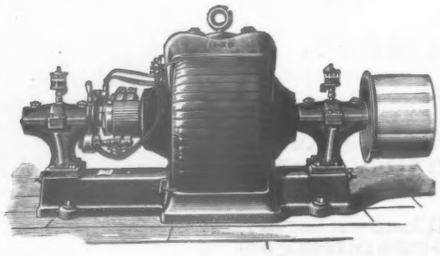

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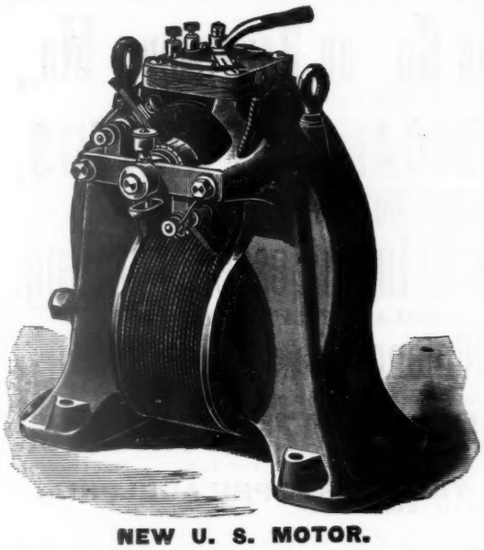

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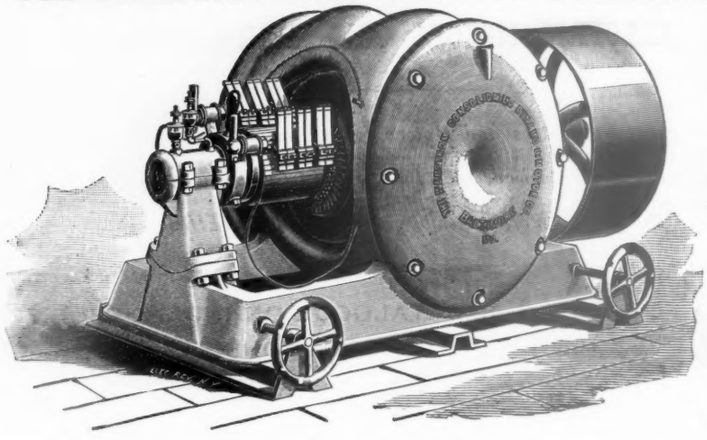

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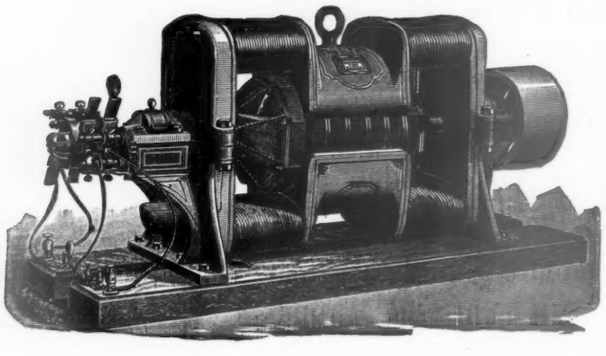

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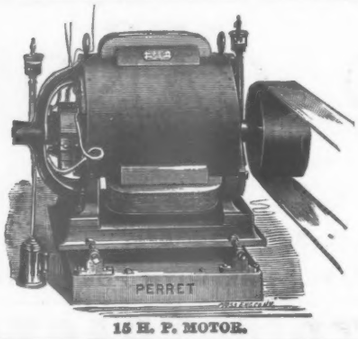

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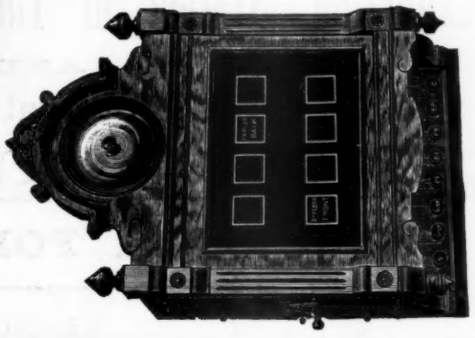

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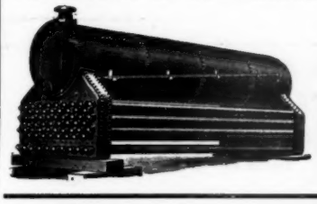

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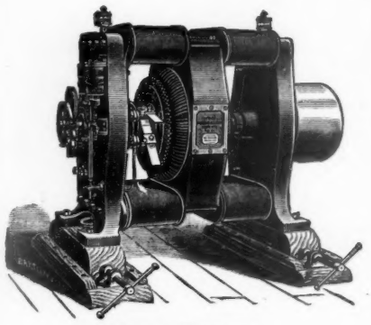

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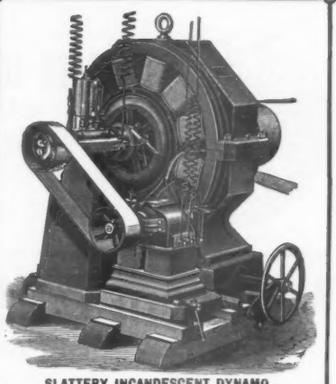

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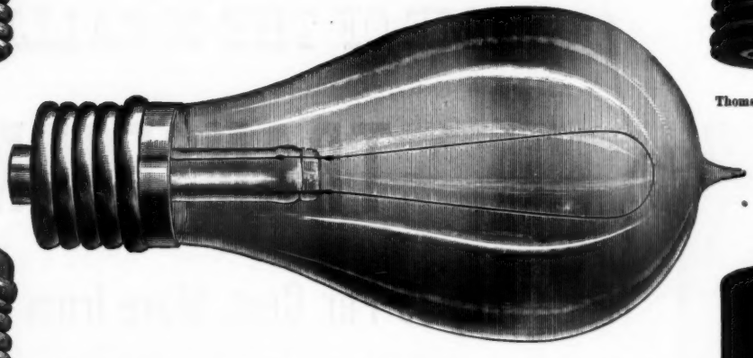

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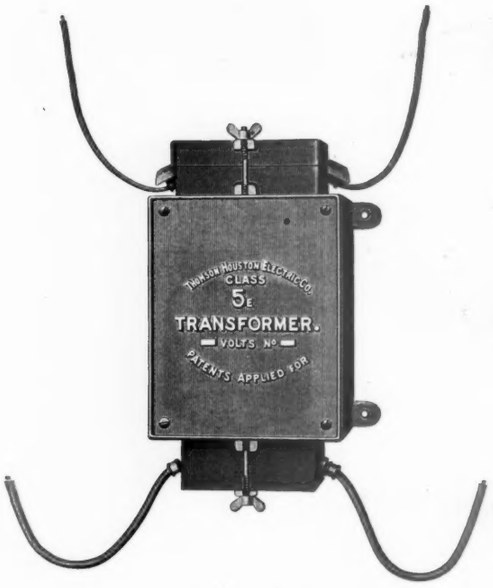

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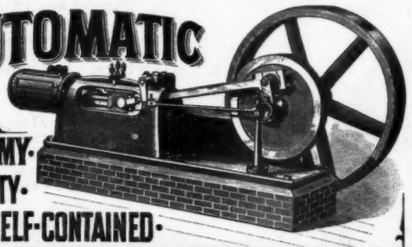

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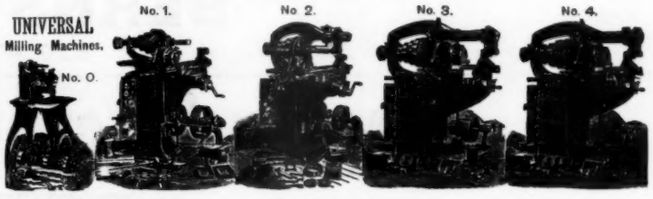

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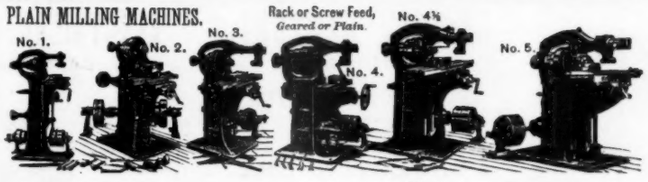

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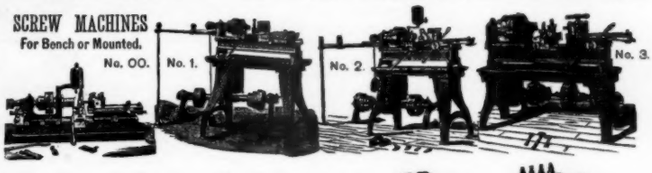

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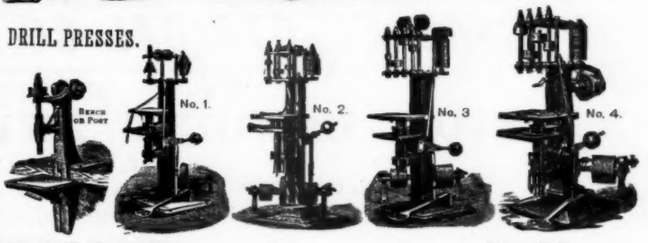

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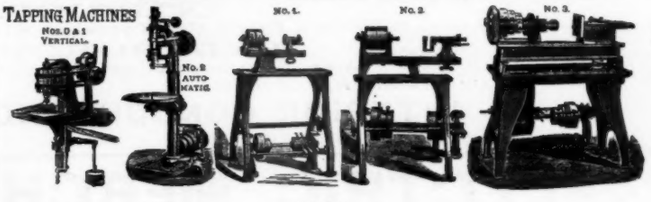

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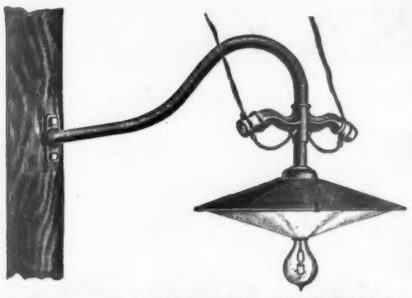

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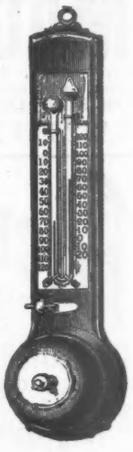

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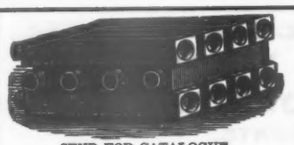

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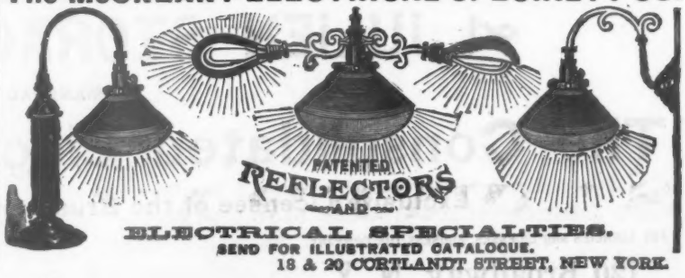

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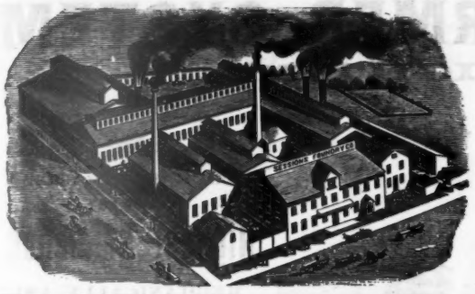

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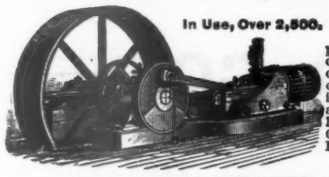

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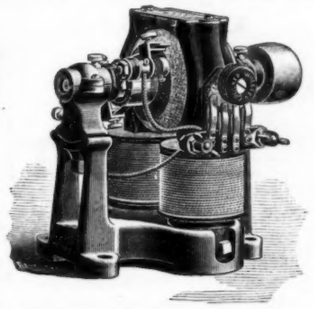

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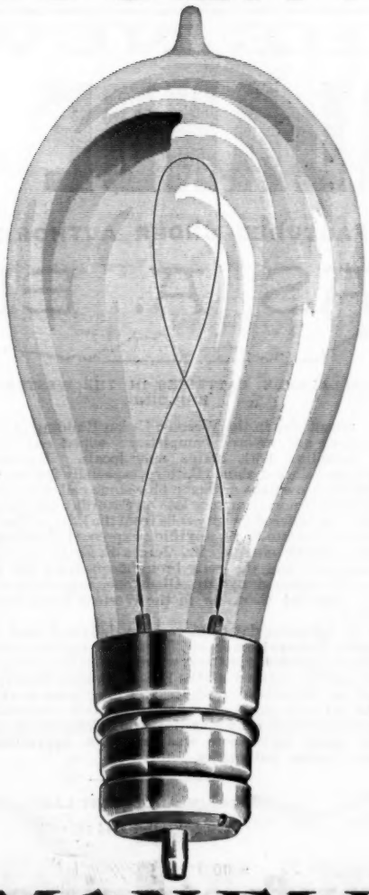

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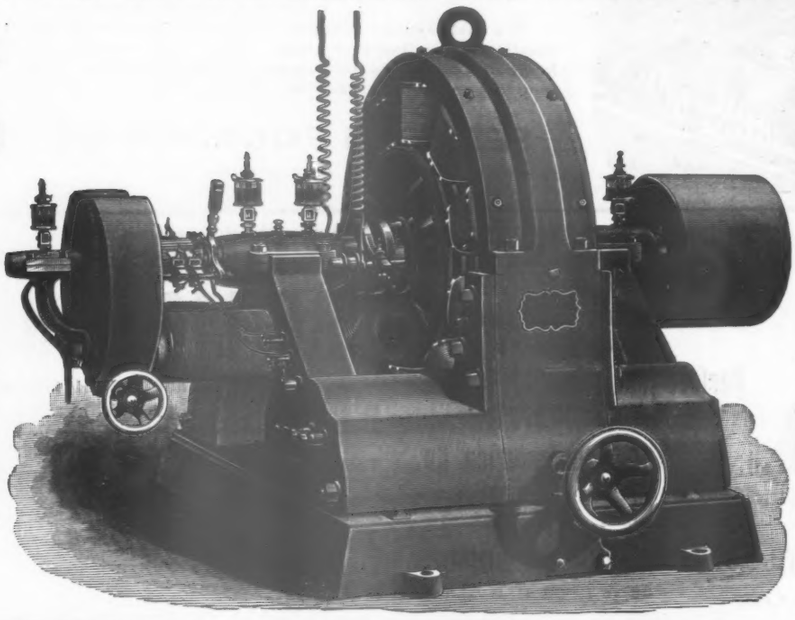

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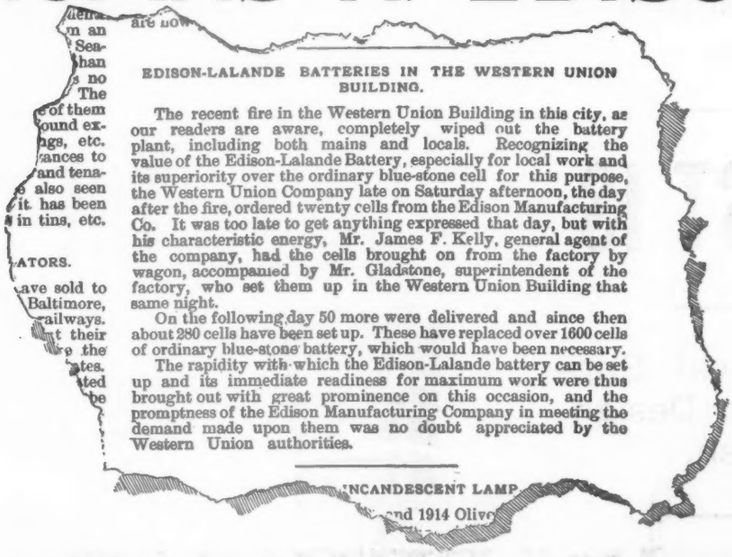

EDISON-LALANDE BATTERIES IN THE WESTERN UNION BUILDING.

The recent fire in the Western Union Building in this city, as our readers are aware, completely wiped out the battery plant, including both mains and locals. Recognizing the value of the Edison-Lalande Battery, especially for local work and its superiority over the ordinary blue-stone cell for this purpose, the Western Union Company late on Saturday afternoon, the day after the fire, ordered twenty cells from the Edison Manufacturing Co. It was too late to get anything expressed that day, but with his characteristic energy, Mr. James F. Kelly, general agent of the company, had the cells brought on from the factory by wagon, accompanied by Mr. Gladstone, superintendent of the factory, who set them up in the Western Union Building that same night.

On the following day 50 more were delivered and since then about 280 cells have been set up. These have replaced over 1600 cells of ordinary blue-stone battery, which would have been necessary.

The rapidity with which the Edison-Lalande battery can be set up and its immediate readiness for maximum work were thus brought out with great prominence on this occasion, and the promptness of the Edison Manufacturing Company in meeting the demand made upon them was no doubt appreciated by the Western Union authorities.

INCANDESCENT LAMP
and 1914 Olive

Edison Manufacturing Company,
JAMES F. KELLY, General Sales Agent, 19 DEY STREET, NEW YORK.

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Ft. Wayne Jenney	87. "	25
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WESTINGHOUSE	95. "	20

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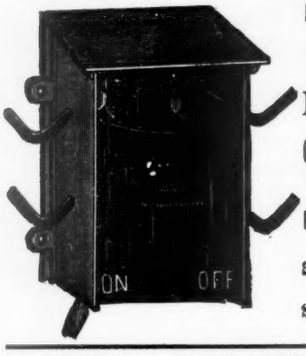

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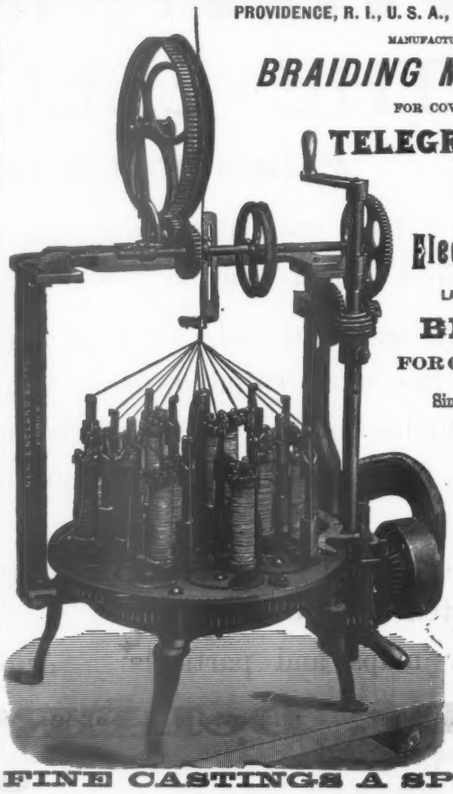

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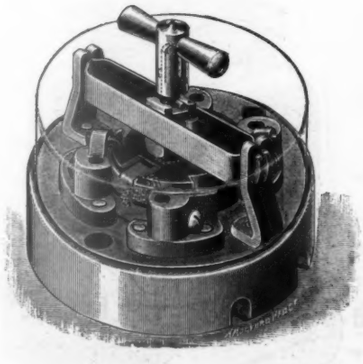

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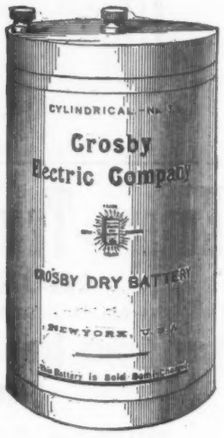

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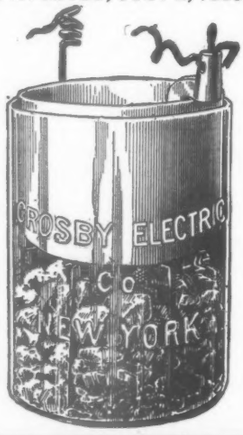

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